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Presented by the Manufacturers  
of the

***CALCULATING MACHINE***

Felt & Tarrant Mfg. Co.  
1713-1735 North Paulina Street  
Chicago

Felt & Tarrant Mfg. Co.

QA

75

.F 325



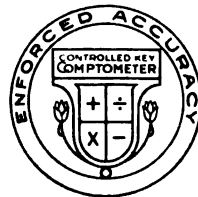






# Applied Mechanical Arithmetic

AS PRACTISED ON THE  
COMPTOMETER



FELT & TARRANT MANUFACTURING COMPANY  
CHICAGO, U. S. A.



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**BY FELT & TARRANT MFG. CO.**

**The Lakeside Press**  
**R. R. DONNELLEY & SONS COMPANY**  
**CHICAGO**

## FOREWORD

This book is designed to illustrate the application of the Duplex Comptometer to many principal lines of business. While primarily for the benefit of our Sales Solicitors, Demonstrators, etc., it should likewise benefit the college student by equipping him with a knowledge of the most efficient methods employed in the mathematics of commerce.

Since the introduction of the Duplex Comptometer, we have been evolving these instructions — giving them out in the form of letters, problems, tables, etc., — teaching them to demonstrators, solicitors, and operators in our training schools; they, in turn, transmitting this knowledge to Comptometer users.

Thus, through these years of evolution, a new method of calculation has been inaugurated. It has developed until the Duplex Comptometer renders easily available new applications of known but heretofore unused mathematical principles. It has, in consequence, become one of the most important and valuable acquisitions in the field of commerce.

The compilation of the instructions and methods thus developed will be invaluable to those desiring to acquire a knowledge of the fundamental principles of this new phase of mathematics.

The Comptometer is operated by direct key-action, and hence is capable of extraordinary speed. This makes it at one and the same time a direct-acting adding, multiplying, dividing, and subtracting machine. The Comptometer is, therefore, especially adapted to perform

adding, multiplying, dividing, and subtracting in one continuous operation, and in any sequence; hence, performing every arithmetical calculation in a direct and practical manner.

Owing to this universal application to figure data, we have been able to introduce new methods of handling the figure work in various lines of business.

The standard of efficiency that has been attained through the introduction of Comptometer methods is unsurpassed.

The unique mechanical design, —

The exactness of gauge, even to the most minute part, —

The severity of the tests, —

The demonstrated durability, —

Unite to prove that the quality of the Duplex Comptometer is unparalleled.

This quality, plus the careful analysis of the office work and personal instruction, is that which enables the Comptometer, the direct-acting, key-driven adding and calculating machine, to produce the highest standard of efficiency.

This volume of "Applied Mechanical Arithmetic," contains:—

General instructions for operating the Comptometer. Illustrations and methods of application to figure data in many special lines of business. Other lines of business and more complete data covering those herein treated will be taken up in succeeding volumes.

# A STUDY OF EFFICIENCY IN ADDING AND CALCULATING MACHINES

Mechanical devices for the performance of figure work have been proved to be superior to the old paper and pencil method because they eliminate much of the drudgery involved, arrive at results in a fraction of the time and with more dependable results than by the old method.

The elimination of unnecessary time and labor is being constantly sought in the advance and development of the arts and sciences. Therefore a study of the efficiency of various types of adding and calculating machines will be of interest.

The following comparisons reveal the great advantage of the Comptometer in efficiency over the other styles of adding and calculating machines, such as the listing, or lever-operated, and the crank-operated machines.

## COMPARISON ON ADDING

To add 9, 8 and 7:

### ON THE COMPTOMETER

The depression of three keys shows the result..... 24

The actual distance traveled by the hand is  $3\frac{1}{2}$  inches.

Time 1 second.

### ON THE LISTING, OR LEVER-OPERATED, TYPE

The 9 key is depressed and then the lever operated;  
The 8 key is depressed and then the lever operated;  
The 7 key is depressed and then the lever operated;  
The lever is operated for spacing;  
The "Total" button is depressed and lever operated to obtain the result.  
The actual distance traveled by the hand is 79 inches.

## COMPARISON ON CALCULATING

532 lbs. @ \$3.87 per Cwt. = \$20.59

### ON THE COMPTOMETER

Take finger position on the multiplier keys, 3 8 7 —  
Depress that set of keys, respectively, two, three, and five times in adjoining positions; result, \$20.59.

The actual hand movement is 12 inches.

Time 2 seconds.

### ON A CRANK-OPERATED CALCULATING MACHINE

Set the regulator for multiplication;  
Set the markers for 387;  
Swing the left-hand lever down to 5;  
Make one turn with the right-hand crank;  
Move the left-hand lever to 3;  
Turn the right-hand crank;  
Move the left-hand lever to 2;  
Turn the right-hand crank; result, \$20.59.

The actual hand movement is 75 inches.

Some of the crank-operated machines require a hand movement of 205 inches for this problem.

### ON THE COMPTOMETER

Take finger position on the multiplier keys, 3 8 7 —  
Depress that set of keys, respectively, two, three and five times in adjoining positions. Result, \$20.59.

The actual hand movement is 12 inches.

Time 2 seconds.

### ON A LISTING, OR LEVER-OPERATED, TYPE

Depress the multiplicand keys, 3 8 7;  
Set the "Repeat;"  
Make two pulls of the lever;  
Release the "Repeat;"  
Reset the 387 to the left one column and set the "Repeat;"  
Make three pulls of the lever;  
Release the "Repeat;"  
Reset 387 to the left one column and again set the "Repeat;"  
Make five pulls of the lever;  
Release the "Repeat;"  
Make one pull of the lever, to space;  
Set the "Total" key;  
Make one pull of the lever, to show answer;  
Tear off paper and read the answer.

The actual hand movement is 163 inches.

This will vary up to as high as 209 inches.

Some of the above types of listing and calculating machines increase their time-efficiency about 30 per cent and decrease the hand travel when driven by electric motor.

The above exhibits very clearly, that, for efficiency in operation, the Comptometer is superior to all the other types of machines combined. For instance, from among these types a choice of the best adding machine can be made; then a choice of the best multiplying machine and the best dividing and subtracting machine. Place opposite them the "Controlled-Key" Comptometer, and in it alone you have greater efficiency on all phases of figure work than from any combination of the other types.

100

**Dorr E. Felt, Inventor**  
**President of Felt & Tarrant Manufacturing Company**



---

## DORR E. FELT AND THE COMPTOMETER

### A QUARTER-CENTURY OF PROGRESS

In creating, developing, and perfecting the Comptometer, Mr. Felt has contributed, in a great degree, to the world's industrial progress.

From the inception of the key-driven type of adding and calculating machine up to the present time, Mr. Felt has had in mind the production of a machine of the direct-acting type that would register the result the instant the key travel was completed—that would operate at the highest possible speed—that would be absolutely dependable when operating keys in unison or with overlapping strokes, two or more keys at the same time—that would be durable in its construction to the highest degree and that would be guarded against mechanical error.

It was not until 1887, after years of experiment, that practical mechanical calculation direct from the key action was made possible by the formal introduction of the Comptometer. In that year Mr. Felt completed and put into practical service his first nine Comptometers.

In the early 80's he whittled out the first model with a jack-knife. A macaroni box was used for the case, pine bars for the segment levers, meat skewers for key-stems and rubber bands for the springs.

The first machines sold were simplex in action; i. e., each key had to be operated singly, because if several keys were operated simultaneously, the carrying of the tens would be lost.

Shortly after the year 1900, Mr. Felt developed and produced the Duplex Comptometer, which was first marketed in the year 1903.

The key stroke on the Duplex Comptometer is much lighter and always the same for each key. The speed is accelerated so as to permit of many hundred strokes per minute—much faster than human hands could operate the keys. The duplex feature provided for the operation of several keys at the same time, operated either in unison or with overlapping key-depressions, and with absolutely dependable results under correct operation.

One of the most wonderful features Mr. Felt made practicable in the Duplex Comptometer, was the performing of any or all of the mathematical calculations in any interlinking sequence. The Comptometer receives a column of addition, changes it to a unit of lower order by multiplying, or to a higher order by dividing, or vice versa; multiplies the result by a price and then subtracts a minus item—all done by successive key depressions and in one continuous operation without clearing the machine. This feature is made doubly efficient because of the fact that the results are absolutely reliable whether the key strokes are made in unison or in any manner overlapping or alternating.

When it is borne in mind that it is immaterial what the interlinking sequence is in which these calculations are performed, and immaterial whether the two hands operate in unison or one in advance of the other, the value of these features of operation in the Duplex Comptometer will be fully appreciated.

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## A QUARTER-CENTURY OF PROGRESS—Continued

The Duplex Comptometer will receive, at practically unlimited speed, a number of extensions containing both decimals and whole numbers indiscriminately, and automatically total the several extensions. This method effects a marked reduction in the time and cost of securing figure data.

It would seem that the general introduction of these methods and the wide-spreading use of the Duplex Comptometer as a real "Arithmetic Machine" should lead to a revision of mathematical textbooks in schools and universities. The demand of the times for most efficient training and service will require a course in the use of the Comptometer as part of the curriculum.

The Comptometer has been fortunate in that the same inventive genius and prophetic vision which originated it has been continuously devoted to its perfection. The history of the Comptometer is a history of Mr. Felt. It is the result of his persistent experiment and steady advancement.

### THE "CONTROLLED-KEY" DUPLEX COMPTOMETER— ENFORCED ACCURACY

The perfecting of the Duplex "CONTROLLED-KEY" COMPTOMETER is Mr. Felt's latest achievement. It introduces a new era in key-driven adding and calculating machines. It is indeed a "block system" in calculation and a safeguard in every "figure phase" of the accounting world.

By specializing and concentrating on the production of an adding and calculating machine, thus perfected, Mr.

Felt has contributed an inestimable service to the commercial world and lightened its work by again "showing the way."

The Multiplex Key Action embodied in the "CONTROLLED-KEY" DUPLEX COMPTOMETER has resulted in the fastest, most dependable adding and calculating machine ever made and sold. It has revolutionized the accounting department. This has been an ideal which Mr. Felt has had in mind and worked on for years. HE DETERMINED TO ENFORCE ACCURACY AND PRECISION ON THE PERSON OPERATING THE COMPTOMETER.

### WHAT THE "CONTROLLED-KEY" DUPLEX COMPTOMETER IS

It is a Direct-acting Adding Machine,—

It is a Direct-acting Calculating Machine,—

Of unapproached light and "velvety" key action, and—

The machine that positively will not add under a partial key depression.

If only a partial depression is made, that column refuses to add and automatically locks the keys in all other columns. This forces the user to stop — allows him to complete the depression of the mis-operated key, touch the release key and continue adding to the end of the column with positive assurance that each key has added its correct value.

The "CONTROLLED-KEY" DUPLEX COMPTOMETER also provides against any possible adding from a neighboring key which the operator may unintentionally touch while depressing a key.

**Factory and General Offices FELT & TARRANT MANUFACTURING CO.**  
**1717-1735 North Paulina Street, Chicago, U. S. A.**

## FUNDAMENTAL MECHANICAL PRINCIPLES OF THE COMPTOMETER

The Comptometer is a calculating machine operated wholly by instantaneous, direct-acting keys. Its keyboard consists of eight or more columns of keys. Each column is composed of nine keys and represents a decimal order of numbers — units, tens, hundreds, thousands, etc.

Some of the Comptometers are made with one or more columns of fractions on the right for adding and automatically converting to the units. Other models are made with columns on the right for adding and automatically converting British currency (£, s, d) and still others for minutes and seconds, etc.

Each key-top bears one of the nine digits, indicating the amount that will be registered on the accumulator mechanism when the key is depressed. The key-top will register ixth and the 0,000. Any may be in- anism by a t the figures

ne, singly or ce, to add a depression is reviously on tes zero and er they rep- ing the five the left one the number e maneuver multiplication

We could have achieved the same multiplication on this keyboard by any one of several other simple maneuvers. As a matter of fact, since the keyboard has a direct-acting key standing for every one of the steps in the scale of notation, we could have divided that number by any other number or have divided any other number by that. Also the square root of the number could have been extracted, by manipulating the keys in accordance with other systems of maneuvering; in fact, we could have performed any arithmetical operation whatever that can be performed mentally or by mind and pencil method.

The rules and systems for maneuvering the keys to perform arithmetical operations are as many and as varied as the rules and systems for performing arithmetical operations by the use of paper and pencil. The Comptometer provides a much shorter and smoother road to the performance of all kinds of arithmetical operations.

Mechanical arithmetic as practised on the Comptometer, being universal in its scope, constitutes in itself a complete system of mathematics.

In the early Comptometers it was necessary to depress each key separately in point of time, else the carrying of the tens would be lost. In the modern or Duplex Comptometer (or more properly speaking, "multiplex" Comptometer) all the keys of any number may be depressed, singly or simultaneously, without in any way interfering with the correct carrying of the tens. Its field of practical utility is thereby greatly extended, its manipulation simplified, and the labor of learning mechanical arithmetic is greatly reduced.

---

## FUNDAMENTAL MECHANICAL PRINCIPLES—Continued

By the old mental method one must first learn how to add varying digital values to a constantly changing accumulation of the same; must learn the multiplication tables; and must learn the number of times a divisor is contained in the whole or a portion of the dividend. By the Comptometer method all of this most laborious work is eliminated. But that is not all; one with no previous arithmetical knowledge whatever could learn to perform all arithmetical operations on the Comptometer by simply learning and practising the rules of maneuvering on the keys in conformance with Mechanical Arithmetic. It would not be necessary to learn the rules

or systems for performing the same operations by the old mental methods.

In the Comptometer method, we employ almost the same vocabulary used in the old mental or pencil-and-paper method. Both are based on the same fundamental laws of mathematics.

The successful marketing of the Comptometer has been due, in addition to the excellent qualities and the adaptability of the machine itself, more to efficient service in teaching its use than to "salesmanship," as that term is ordinarily understood.

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**FIRST ROUGH MODEL**



**You Must Opera**

**MODEL "E" "CONTROLLED KEY COMPTOMETER**

The Automatic Key Lock is the greatest advance in adding and calculating machines since the introduction of the Duplex Comptometer.

## COMPTOMETER EFFICIENCY

### SERVICE—INVESTMENT RETURNS

Comptometers, in the point of service rendered, as a matter of record, have returned as high as **300% per annum** on their cost.

For instance—The Union Pacific Railroad Co. recently installed 12 Comptometers in one Department at a cost of less than \$3,400.00.

At the end of the first year an accurate record of the work was kept for one month. It was found that they had **reduced** their pay-roll **\$819.00 per month** or practically **\$10,000.00 a year** by the \$3,400.00 investment.

### INITIAL COST RETURNED THREE TIMES ANNUALLY

This is a return 25 times greater than some large corporations figure is required of a mechanical device in order to make it a good investment.

They say that a machine that will return \$700.00 annually will warrant an investment of \$6,000.00. On this basis the Comptometers at a cost of \$1,000 or \$2,000 each would have made an excellent investment.

The Comptometers above mentioned have been used **five years** rendering the **same service year after year**.

### THE REAL SERVICE—SATISFACTION

The "man who knows" will tell you that, when his

Adding,  
Invoice Extending,  
Purchase Proving,

Cost and Statistical data, etc., are **originally** computed and the results **proven** on the Comptometer, he has the **final assurance of accuracy**.

### SATISFACTION,—PLUS

This assurance of accuracy combined with the **greatest speed and highest efficiency** is the result of continued Comptometer Service.

### HOW MUCH USE WARRANTS THE PURCHASE

Among smaller concerns Accuracy is valued at an amount much greater than the interest on the investment. Further benefits derived are in the nature of Convenience, Ease and the Saving of Time and Mental Energy to be employed in the further development of the business.

The cost of the Comptometer, including the interest on the investment and the up-keep complete, is only \$3.00 or \$4.00 per month. This means about one twentieth of the cost of the average clerk, making it the cheapest and most effective assistant possible in the office.

Let it stand **sponsor** for their figure accuracy.

---

## WHOLESALE HOUSES

The unlimited mathematical possibilities of the Comptometer render its practical application to business problems only limited by the demands of commerce.

The system illustrated is taken from a wholesale house having a business which requires fourteen (14) ledgers. The same ideal service is rendered to a smaller house which would have use for but a single ledger.

### THE ORIGINAL ORDER—MAKING MANIFOLD COPIES

The original orders are received and given consecutive numbers. Then three manifold copies, bearing the same numbers, are written by a typist. The original order is now filed with the letter correspondence.

The manifold original follows the general routine of the office; i. e., through the —

- Credit Department
- Traffic Department
- Shipping Room
- Packing Room
- Price Clerk and Billers
- The Typist for Making Invoice.

It is then filed alphabetically for City Orders and geographically for Country Orders.

### The Use of the Manifold Copies:

The two copies form a perfect check against unfilled orders and are a great convenience in case an order is lost or delayed.

#### OFFICE OF WHOLESALE HOUSE USING COMPTOMETERS

One of the copies is at once filed alphabetically for City Orders and geographically for Country Orders. This is for instant reference instead of looking up the original which is passing through the house. The other is filed numerically as a ready reference if only the number is known.

---

**EXTENDING THE ORDER**  
**AS FIGURED BY COMPTOMETER OPERATOR**

The Price Clerk applies all the unit prices, then turns the order over to a Comptometer operator, who figures the extensions and adds the invoices on the Comptometer.

**OPERATOR FIGURING EXTENSIONS ON COMPTOMETER**

In extending the orders many items are at a net price or so simple that the amount is seen at a glance; these figures are entered directly by the operator. Other items merely require the extension of quantity by price; as for instance, 14 lbs. at  $16\frac{1}{2}c$ . These are extended on the Comptometer by use of the Fixed Decimal Method, so that no pointing off is required, the dollars always showing under certain white columns of keys, while the cents are at the right under the columns of black keys, making an easy distinction.

Other items again are subject to a discount, such as 2,360 ft. at \$12.40 per mile, less a discount of 35%. These extensions are also made over the Fixed Decimal and the gross extension multiplied directly by the net of the discount.

When the various extensions are completed they are added for the total. Then, whenever items of express or freight are to be deducted they are subtracted out of the total without clearing the Comptometer, thus giving the net of the invoice.

---

---

## **THE INVOICE**

When the orders have been figured and added they are arranged alphabetically in ledger order.

### **TYPEWRITING THE INVOICE AND HOUSE SHEET**

A typist writes up the invoice and makes a carbon copy for the House or Charge sheet. The House Sheet is then turned over to a Comptometer operator.

---

## PROVING INVOICES THROUGH THE HOUSE SHEETS

From the typist the House Sheets are taken in charge by a Comptometer operator.

### OPERATOR PROVING HOUSE SHEET EXTENSIONS AND ACCUMULATING TO TOTAL ON COMPTOMETER

The Comptometer is now employed to re-figure the "House Sheets." When several items are on one invoice the Comptometer accumulates the extensions to the total of the invoice. **This proves both the extensions and the additions in one operation.**

Refiguring the typewritten House Sheet guards against any possible error in transcribing. The errors thus caught and corrected before the invoice leaves the office are:—

Errors in transcribing — Quantities  
Prices  
Extensions  
Totals

Errors in extensions or additions or misreading a figure.  
This re-figuring of the House Sheets is a practical safeguard on the invoicing and assures accuracy in the figure work.

---

BILLINGS HARDWARE COMPANY

Sold to - A. M. Arkell,  
Peoria, Ills.

June 1, 1913.

		Price	Gross Ext'n.	Net Ext'n.
1 doz.	#0 Brass Safety Chain @ Less 55%	1.75	1.75	.79
4 Rolls	48" Galv. Poultry Netting (2400 sq. ft. @ 3 1/4) Less 75-10%		84.00	18.90
1/2 doz.	#4 Ice Chisels @	1.25		.31
5 lbs.	1/2" Washers @	6 1/4		.33
5 "	5/8" " @	6 1/4		.30
				<u>\$20.63</u>

Sold to - J. A. Stark,  
Hammond, Ind.

2 gals.	Turpentine @	.75		1.50
1 can	@			.25
1/12 doz.	Disston Hand Saw, 8 pt. Less 22 1/2%	65z. 26.00	2.17	1.68
790 lbs.	2 pt. Barbed Wire	per 100 3.60		28.44
334 "	Galv. Wire	" " 3.85		12.86
				<u>\$44.73</u>

A SECTION OF THE HOUSE SHEET  
THE HOUSE SHEETS ARE 11"x17"

## POSTING FROM THE HOUSE SHEETS

The House Sheets are now put in loose leaf binders in alphabetical ledger order and turned over to the Bookkeeper.

The Bookkeeper, upon receiving the House Sheet Binder, posts the items to his ledgers. The arrangement of the invoices on the House Sheets enables him to post the items to each ledger in alphabetical order.

### **The Posting:**

A number of Debit and Credit Markers are at hand and as he posts each debit entry he drops a **Debit Marker** in the ledger, allowing it to project about an inch from the lower or near side of ledger.

When the Credit Postings are made from the Cash Book and other sources, **Credit Markers** are dropped in the ledgers.

The Bookkeeper enters on the Daily Control Sheet the various totals of items posted from the several sources, i. e., the "Sales," "Journal," "Voucher Records," etc.

### **BOOKKEEPER POSTING FROM HOUSE SHEETS**

When the posting is completed the ledger is turned over to a Comptometer operator for proving the postings.

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**PROVING THE POSTINGS  
THE "DAILY CONTROL"**

A few minutes proves the postings for the day and assures a quick Trial Balance at the end of the month.

**PROVING THE POSTINGS AND ENTERING TOTALS ON THE DAILY CONTROL SHEET**

The Comptometer is placed right beside the ledger. The Debit postings for the day, as indicated by the Debit Markers, are added. This will include the Debit postings from the several sources combined, say, the "Sales," "Journal" and "Voucher Records." The totals of **original items** posted from each of these sources, as entered on the "Control Sheet" by the bookkeeper, are cross-added and, if the total of the posted items agrees with same, it is then entered on the "Daily Control" in the "Total" column. The same process is applied to the Credit postings.

With the 12-Column Comptometer, a Debit and Credit Key Shield is used and the credits are added on the right side and the debits on the left of Keyboard. This permits the adding of both debit and credit postings at the same time.

---

### BALANCING THE LEDGER ACCOUNTS

When the postings are completed for the last day of the month, the 12-Column Comptometer is placed right beside the ledger, to balance the ledger accounts in the simplest and surest manner possible.

#### 12-COLUMN COMPTOMETER READY TO BALANCE THE LEDGER ACCOUNTS

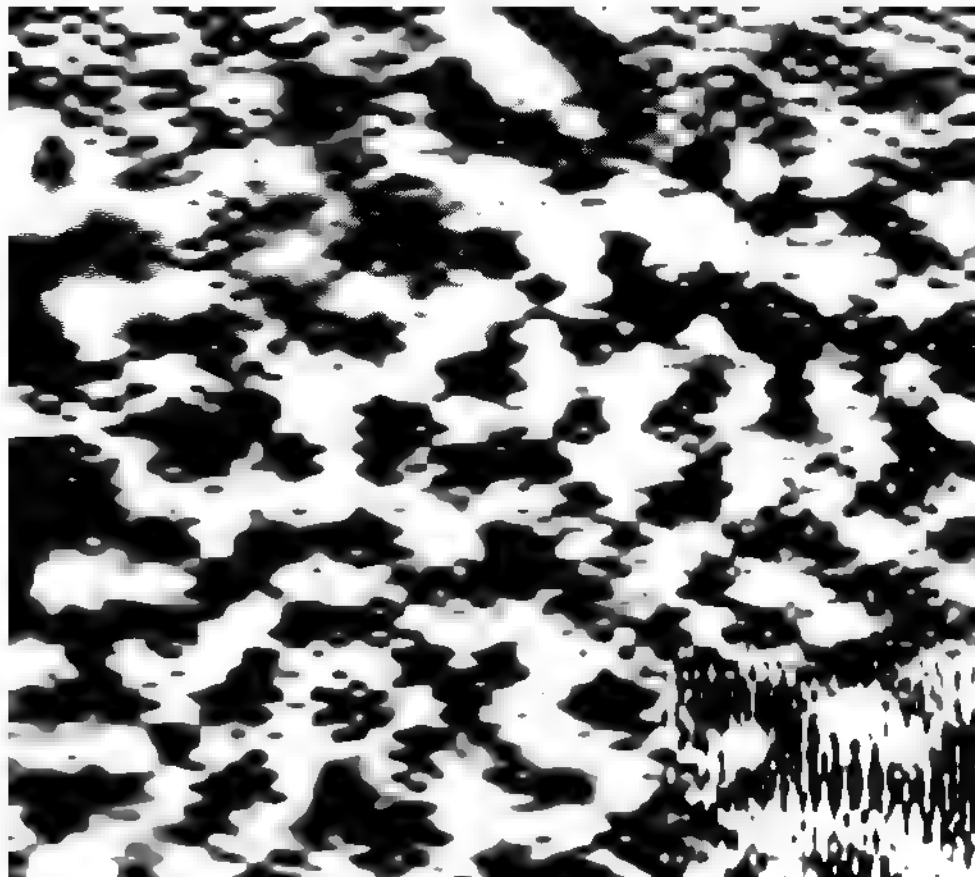
The debit items of an account are added on the left side of Keyboard; the credit items on the right side. The totals are penciled in, the amount of credit is subtracted from the debit and the balance is noted in the balance column.

The amount of the balance is now in the left side of the register and the credit in the right side. **The subtraction is proved** by merely adding back to the balance the amount of the credit, which is still before our eyes in the register.

---

READING THE TOTALS

### MAKING OUT THE MONTHLY STATEMENTS



The items have been posted on the ledgers daily. The Postings have been proven daily and now the accounts have been balanced.

The Monthly Statement will, therefore, resemble the figures of the ledger account for the current month.

So we place the ledger beside the typewriter and make a copy of the account, the totals and balance on the statement, of course, being the same as the ledger total and balance.

### ADDING THE STATEMENTS

As we wish to have an **absolute safeguard** on the accuracy of the statements, we add them direct on the Comptometer. This gives a positive proof against any error in transcribing. It gives us this positive proof without reverting to the old method of proof-reading or calling and checking.

---

**TAKING THE TRIAL BALANCE**

The Ledgers are now ready for the Trial Balance. Here again the Comptometer Method appears as absolutely the most efficient known.

(Comptometer Method continued on following page.)

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## TAKING TRIAL BALANCE—Continued

### COMPTOMETER METHOD

The **Comptometer Subtotal Trial Balance Sheets** are inserted in the Loose Leaf Ledgers at intervals of from 30 to 50 pages, or at the end of each, or one at the end of several Index Sections. These remain permanently in the ledger. One set of 8½ x 11 Subtotal Sheets will serve for four years; the 11 x 11 for six years.

With the Comptometer **right beside the ledger**, add the debit balances of all accounts up to the first Subtotal Sheet and jot down on the sheet the amount of the debit balances up to this point. Leave the total in the Comptometer and add to it the balances of the next section. Jot this **running total** on the Subtotal Sheet and continue in the same manner throughout the ledger.

The last Subtotal Sheet will thus record the totals of the Debit and Credit Balances.

These totals for each ledger must balance against the corresponding "Ledger Control Sheet" which was made up daily when postings were proven. Also the total Debits and Credits of the one or more ledgers must balance.

#### To Prove:

The Comptometer way is the best of all.

Simply re-add the original balances of each ledger section and check mark the **corresponding running totals** on Subtotal Sheets. If any **running total** fails to agree with the first total, showing an account has been overlooked or a figure misread, it is corralled in that one section, which you re-add and have positive proof. Any correction is noted in the Correction Column on the corresponding and final Subtotal Sheets. All running totals are left undisturbed.

The Comptometer Method Means:—

That about eleven out of twelve times the ledgers **balance the first time over**.

The tedious task of looking for errors is practically eliminated.

All proofs are through the medium of **original figures: the proof without a peer.**

### THE COST BY DEPARTMENTS

The House Sheets, i. e., the carbon copies of the invoices, are turned over to the Cost Department to work up this data.

#### EXTENDING MERCHANDISE COSTS BY DEPARTMENTS

##### COMPTOMETER METHOD

The cost of goods sold in a department is determined in one accumulative operation.

The House Sheets are placed right beside the Comptometer.

Each quantity is extended by its Cost price and the results accumulated to the total cost of the Department Sales for each Salesman.

These Department Costs are then entered on the "Cost Sheet" daily. At the end of the month they are added on the Comptometer and the Department Totals are entered on the Analysis Sheet from which the percentages are figured.

---



## THE SALES AND COST STATISTICS

The **manifold original**, which was priced, extended, and totaled, is turned over to the Sales Distribution Department.

In connection with the Sales Analysis the principal information wanted is:—

The amount of Department Sales by each Salesman.

The per cent of profit per Department from each Salesman.

The per cent of Department Sales to the total of each Salesman.

The per cent of Department Sales of each Salesman to the total Department Sales.

The Department per cent of selling cost for each Salesman.

### DEPARTMENT SALES

All orders for each salesman or territory are put in a binder daily. These sales are abstracted directly on the

Comptometer for two departments at a time.\* This may be done daily or at the end of several days. Then these department totals are entered on the distribution sheet under their respective departments. In this manner the total sales per salesman for each department is determined and the sales for all salesmen easily and quickly distributed.

### PROVING

When the distribution has been made, cross-add the departmental distributions and prove against the total sales distributed; also the total distributions must prove against the debit postings to the Daily Control Sheet for the corresponding period.

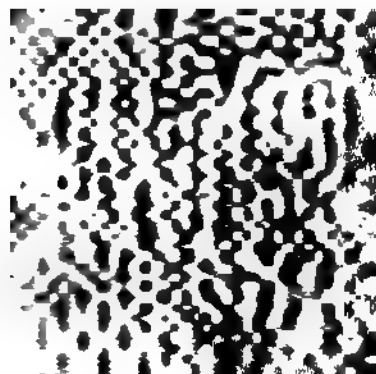
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\*A Key Shield is used and the distribution for one department is added on the right side of the Comptometer and the other on the left side.

### THE MAKING

The deposit slip is written up in on the Comptometer, securing results c

He then adds the checks directly on the Comptometer. This total, balancing against the deposit slip, proves the accuracy beyond doubt. If there are a great many checks, he will jot an occasional **running sub-total** on a slip and drop it in the **pile of added checks**. This facilitates the proof in case of misreading a figure, turning two checks at once, or any other error.



BALANCING THE CASH BOOK

### ADDING CHECKS ON THE COMPTOMETER

The "Controlled-Key" Comptometer is the cashier's delight.

He places it on his cash book. With his eyes directed to the column of figures, he adds the items "by touch." His fingers soon acquire the habit of adding automatically. He reads his total the instant the last key is depressed.

In this manner he adds the various columns of Cash Distribution. He adds first the cash items for his Credit Total; then clears the machine and adds the several columns of debits to the Debit Total. Then, with this amount in the register, he subtracts out the credits, leaving the Balance, which proves with the Cash On Hand.

# **OPERATING INSTRUCTIONS**

**Correct Position for Holding the Pen or Pencil while Operating**  
**This Allows the Free Use of the Fingers and the Pen or Pencil is Ready for Instant Use in**  
**Jotting Down the Answers**

# OPERATING INSTRUCTIONS

## ADDITION

### THE FULL KEYBOARD METHOD

The "Full Keyboard" Method is devised for the man who will use the Comptometer only occasionally. Use the push stroke; it is exceedingly simple and will, from the first, produce absolute accuracy and fair speed.

It is easy to add on the Comptometer with Conscious Accuracy. The finger should be placed on the Key — then push it down.

When adding Dollars and Cents the two Columns of White Keys at the right are used for adding the cents and the keys at their left for adding the dollars. Thus:

2 Right Hand Columns of White Keys, cents	\$0.65
1st Column Black Keys, Unit of \$'s . . .	7.00
2d Column Black Keys, Tens of \$'s . . .	70.00
3d Column Black Keys, Hundreds of \$'s . .	700.00
1st Column White Keys, Thousands of \$'s .	7,000.00

## DIRECTIONS

Add:	\$7.65
	3.48
	78.65
	347.89
	<hr/>
	\$437.67

Add each number according to the large figures on the Keys.

First:— Place the finger, and let it come to a rest on the \$7.00 key (First column of Black Keys).

Now push the key down as far as it will go, then let it return to normal position, slide the finger across the keys to the 60 cent key and push it down, then to the 5 cent key. Then, without removing the hand from the keyboard, slide the fingers across the key tops to the 3 dollar key, and continue in the same manner.

**Remember,** place the finger on each key, then push it down. Operating the Comptometer in this manner will eliminate that uncertain stroke which would occur by raising the hand an inch or two and letting the finger strike the keys.

**ADDING HOURS AND MINUTES****FROM BOOK ENTRIES OR COLUMNS**

8 hrs. 37 min. Add the minutes in the cents  
 11 " 45 " columns.  
 7 " 8 " The register will show 169—  
 8 " 53 " reduce this to hours by dividing  
 9 " 26 " by 60—register now shows 2—  
 — 49—  
 (\*2) 169 Then add the hours in the third  
 — — and fourth columns—  
 45 49 Result shown by register 45  
 hrs. 49 min.

(\*Carried from the minutes column and already in the machine)

**FROM TIME SLIPS OR CARDS**

Add both hours and minutes with the **one handling** of the time cards.

Add the hours on the 3 columns of White Keys, and the minutes in the cents columns.

The first register result in the above will show 4300169.

Divide the minutes by 60 using the intervening small cipher black keys to throw the converted hours in the corresponding hour column.

Depressing the intervening small cipher keys at the same time as dividing, will throw the converted hours into the hours column.

Answer. 45 Hr's 000 49. Min.

**ADDING HOURS AND MINUTES**

When Fractions of Hours are  $\frac{1}{4}$ ,  $\frac{1}{2}$ , or  $\frac{3}{4}$ :

**FROM BOOK OR COLUMNS**

First add the fractions decimally in the cents columns.

Use the .25 Keys and add repeatedly for the number of quarters, then add the hours.

8<sup>1</sup> 9 9<sup>2</sup> 7<sup>3</sup> 8<sup>2</sup> 6<sup>1</sup> Answer 49.25

**FROM TIME SLIPS OR CARDS**

Add hours and decimals in the regular manner as  
 8.25 - 9 - 9.5 - 7.75 - 8.5 - 6.25 Answer 49.25

**ADDING LOOSE CHECKS, BILLS, ETC.**

For this class of work the Comptometer is supreme.

Department stores having from 1,000 to 50,000 or more cash and charge checks daily, have learned how to cut their auditing expense in half by using Comptometers on this class of work.

When adding a great many bills or checks, jot an occasional Sub-total on a slip of paper and drop it on the pile of **added checks**; it is then a very simple matter to prove. Simply re-add, checking each Sub-total. In case of an error, it is necessary to re-add only that section where the error shows.

**ADDITION OF YARDAGES****WHEN THE FRACTIONS ARE EXPRESSED IN QUARTERS****EXAMPLE—**

62<sup>s</sup> First: Add the fractions decimally in the  
 61<sup>s</sup> cents columns, thus:  
 58<sup>1</sup> Hold the 2 and 5 keys, representing  $\frac{1}{4}$  or  
 59<sup>s</sup> .25, and add repeatedly for the number of  
 64<sup>s</sup> quarters in each respective quantity, i. e.,  
 — 3, 2, 1, 3, and 2, times.  
 Then on the Black Keys to the left add the  
 yards.  
 The register should now show a total of  
 306.75.

**WHEN THE FRACTIONS ARE EXPRESSED IN EIGHTHS**

56<sup>1</sup> Place the decimal point between the 3  
 74<sup>s</sup> columns of White and Black Keys; because  
 85<sup>7</sup> of a greater number of decimal places.  
 77<sup>s</sup> Add the fractions decimally:  
 63<sup>s</sup>  
 — .125  
 .625  
 .875  
 .75  
 .375 Then add the yards on the  
 White Keys to the left.  
 Answer 357.75.

Or, using both hands, hold .125 and add repeatedly  
 for the number of eighths in each quantity.

Then add the yards.

Answer 357.75.

**ADDING 32nds AND 64ths**

This work exists in the engineering department  
 of many metal goods manufacturing concerns.

Example, 6-13/64

7-37/

8-52/

5-49/

3-28/

The best plan is to add the number of 64ths on the  
 right of the machine and the whole numbers on the  
 group of 3 white Keys,

Register showing 2900179

Then reduce the 64ths to units, dividing by 64  
 and using the intervening small cipher Black Keys  
 to throw the unit quantity in the correct column.

Operating these three **small cipher keys** will throw  
 the converted whole numbers into the whole num-  
 ber column.

Answer 31-51/64

## ADDITION

### TOUCH METHOD

The Touch Method is devised for the operator who will use the Comptometer for a half hour a day or more and wishes to become a highly efficient operator. It is **very simple** and admits of almost unlimited speed.

Use only the lower half of the Key Board; every key to be operated is within easy reach of the fingers, with but slight movement of the hand.

The **odd** keys, 1, 3, 5, etc., are provided with **cupped** tops, while the **even** keys, 2, 4, etc., have smooth tops.

Owing to the sense of feeling this makes the **Touch Operation** very simple.

For 9 add 4 and 5 in the same column

" 8 " 4 twice " " "  
" 7 " 3 and 4 " " "  
" 6 " 3 twice " " "

Add the following single columns using the first finger of Right Hand:

Find the keys by **feeling**, using the cupped 3 key as a guide.

This exercise is to memorize the above combinations and key positions.

8	3	5	5
7	8	2	3
6	9	1	6
5	6	9	9
9	7	2	7
4	4	8	1
7	2	7	8
8	1	6	2
<hr/>			
54	40	40	41

### USING TWO FINGERS

Add the following columns, beginning at the top of each column and adding down. Use the first and second fingers of the right hand. Keep **each finger** in its **own column**. Find the keys by feeling. Go slowly and carefully, speed comes with continued use.

12	36	43	38	59	84	67
45	34	63	43	64	25	67
38	13	12	26	12	97	33
54	32	84	13	47	65	54
11	55	23	48	62	27	44
34	35	32	34	45	28	64
36	88	28	63	43	26	25
12	26	27	26	33	29	37
42	24	36	21	35	13	77
33	35	63	36	83	21	52
<hr/>						
317	378	411	348	483	415	520

67	45	33	54	44	25	77
84	67	97	65	27	26	13
59	25	13	47	62	43	35
38	64	26	13	48	63	21
43	43	24	84	23	28	36
36	63	13	32	55	96	52
12	34	38	54	11	88	83
18	82	42	19	63	36	42
23	53	35	72	17	41	12
16	29	81	91	81	72	93
<hr/>						
396	505	402	531	431	518	464



### TOUCH METHOD—Continued USING THREE FINGERS

Inasmuch as in the ordinary invoicing and cost work a large portion of the items will be in three figures, i. e., the units of dollars and the cents as 1.37, etc., it is better to develop well the use of three fingers in the Touch Method.

Add these columns in the following manner:

First finger on the hundred's column.

Second finger on the ten's column.

Third finger on the unit's column.

Keep each finger in its own column.

4.65	6.43	3.75
3.33	2.34	5.76
1.25	3.75	3.46
6.78	4.96	3.51
3.11	4.22	3.56
5.25	4.34	4.36
1.50	5.09	3.27
6.67	8.87	8.98
4.32	5.43	6.54
2.25	6.11	4.78
7.67	8.54	4.56
5.56	4.96	7.78
<hr/>		
52.34	65.04	60.31

In dealing with "department totals," etc., the items will largely run into the hundreds of dollars, as 375.26, etc. On such work the best plan is to add the cents columns first with two fingers, then leaving that result in the machine add the three columns of dollars with three fingers.

In the following columns add the cents first with the 1st and 2d fingers. Leave this total in the register and add the dollars with the 1st, 2d and 3d fingers. Keep each finger in its own column.

354.00	122.00	354.64
573.68	65.98	443.45
21.33	127.43	100.67
100.87	60.45	45.00
32.40	22.65	45.78
167.68	100.00	78.64
236.35	453.67	10.00
33.00	25.25	188.78
345.65	600.00	498.00
100.45	22.58	63.55
34.48	266.57	413.75
500.00	310.00	213.00
118.44	342.12	67.00
341.65	45.00	47.23
66.00	78.23	33.45
<hr/>		
3025.98	2641.93	2602.94

## MULTIPLICATION

Multiplication is performed on the Comptometer by depressing the multiplier keys in the units position as many times as indicated by the units figure of the multiplicand; then moving to the left one column and depressing as many times as the tens figure of the multiplicand, etc.

There are various methods of manipulating the keys in performing multiplication, which will be taken up on the following pages:

### MULTIPLYING

#### Example:

$$432 \times 39$$

Place the first finger of each hand on the multiplier keys **39** in the units and tens columns.

Depress the keys, together, twice; then move the fingers to the adjoining keys at the left and depress three times, when again move one column to the left and depress four times = **16848**.

#### Key Stroke Exercise:

The following is a good manipulation to acquire a ready key operation:

Place the fingers on the **39** keys on the right side of Keyboard (units and tens columns). Look away from the Comptometer and multiply **7654321**. Move the fingers to the neighboring keys on the left each time by the sense of feeling. Give the keys a **full depression** and allow a **full return**, i. e., let the fingers come just off the key tops on the up-stroke.

Repeat this two or three times; then reverse, commence at the left side of Keyboard and multiply towards the right **7654321**.

With concentrated effort, a fair degree of efficiency in manipulating the keys for multiplying is acquired very quickly by the beginner.

---

**TWO FINGER MULTIPLIERS**

Example,  $1364 \times 57$

Hold 57 with the first finger of each hand. Depress these multiplier keys four times (multiplies  $57 \times 4$ ). Then move both fingers to the left one column and depress 6 times, then in the next position three and one times respectively.

At first, when learning multiplication, always confine yourself to the use of the first finger of each hand. Give each key a **full push stroke** and allow a **full return**.

In each of the following examples use the first finger of the **left hand** for the tens figure of the multiplier and the first finger of the **right hand** for the unit figure:

24,531 35	12,456 68	5,315 64	23,456 75	84,143 79
858,585	847,008	340,160	1,759,200	6,647,297
35,642 45	15,341 88	45,673 28	36,341 23	14,683 47
1,603,890	1,350,008	1,278,844	835,843	690,101
89,986 37	15,366 15	65,418 31	94,345 63	14,312 86
3,329,482	230,490	2,027,958	5,943,735	1,230,832
26,433 19	46,541 91	63,222 83	46,821 61	46,533 11
502,227	4,235,231	5,247,426	2,856,081	511,863

**THREE FINGER MULTIPLIERS**

Where the Multiplier consists of three figures, the Key Position should always be taken so that the second, or longer, finger takes the higher key.

EXAMPLE: Multiplying by 359 —  
 $82,719 \times 359 = 29,696,121$

$$95,401 \times 673 = 64,204,873$$

$$13,728 \times 238 = 3,267,264$$

$$43,721 \times 139 = 6,077,219$$

Any Multiplier larger than three figures should be split. (See following page.)

**THREE FINGER MULTIPLIERS—Continued**

The illustration below shows the proper Key Position for multiplying by 174.

EXAMPLE:

$$27,415 \times 174 = 4,770,210$$

$$\begin{array}{l} 32,506 \times 931 = 30,263,086 \\ 17,328 \times 821 = 14,226,288 \\ 42,571 \times 1075 = 45,763,825 \\ 35,729 \times 197 = 7,038,613 \\ 71,241 \times 376 = 26,786,616 \end{array}$$

The same principle applies when using five figure multipliers and splitting the multipliers according to the directions on this page.

**SPLITTING THE MULTIPLIER**

Accuracy is the first requisite of all work.

Using only 2 keys at a time, one finger of each hand, enables one to make a full and even key stroke with the least attention to the key operation.

This is the best and speediest method of using the Comptometer on large multipliers.

Multiply 35474 by 8356

Take the first key position on 56, use one finger of each hand, and multiply through by same, then take 83—in their proper columns, (3d and 4th) and multiply through.

Use this method with all four or more figure multipliers and instruct in like manner on all trials.

The line in the Multiplier indicates where it should be divided.

35474	16345	28351
83 56	25 17	98 47
<u>296420744</u>	<u>41140365</u>	<u>279172297</u>
37529	47316	91473
26 45	52 91	36 29
<u>99264205</u>	<u>250348956</u>	<u>331955517</u>

Where 5 figure multipliers occur, use one finger of each hand on first part of operation and finish problem with one finger of one hand and two of the other.

9245	7415	7461
357 63	239 38	351 27
<u>330628935</u>	<u>177500270</u>	<u>262082547</u>

**FOR SPEEDY WORK**

NOTE: 35474 × 83|56

Hold 83—and multiply through, towards the right, by 3—5—4—7 and 4. Then, merely shift to the 56 keys in the next two columns and multiply back towards the left—(or reverse and first multiply towards the left, returning towards the right).

This makes changing key positions for the Split Multiplier very rapid and easy.

## MULTIPLYING FROM LEFT OF KEYBOARD

Multiplying a problem like that below on an 8-column Comptometer from the right you will run off of the Keyboard at the left, where the amount is the largest.

If you reverse and commence at the left of the Keyboard and multiply toward the right, the amount lost is so small a decimal as to make no appreciable difference with the result.

Multiply 453.27 by 387.658  
Split the multiplier 387.658  
1st. Hold 387 on left  $\times 453.27$ .  
2d. " 658  $\times 453.27$   
Drop each figure of the multiplier as it runs off of the Keyboard = Answer 175712.736.

## POINTING OFF WHEN MULTIPLYING FROM LEFT OF KEYBOARD

In multiplying from the left side, or the whole number end, point off as many register holes as there are whole numbers in both factors.

347.526	6475.46
5.4167	75.3
1899.9246+	487602.138
1.465	57.392
674 352	376.1347
987.92568	21599.3063+
21599.3063	Answer with 8 column machine
21599.307024	" " 10 or 12 column Compt.

Where either or both factors contain ciphers at the Right of the Decimal, the same must be deducted from the whole numbers in pointing off; i. e.—

6432.	13.006	.0765
.0039	.008	.0069
25.0848	.104048	.00052785
4 whole numbers	2 whole numbers	0 whole numbers
2 ciphers	2 ciphers	3 ciphers
2 places to point off	Point remains at left of Reg.	Point moves to the left 3 places

These examples can be worked on a 10-column machine, from right to left, but many problems found in statistical work require the use of the above method on the larger machines.

## MULTIPLYING THREE FACTORS

$$485 \times 327 \times 48.$$

First multiply 485 by 327 equals 158595.

Leaving this result in the machine, is equivalent to having multiplied it once, therefore multiply it 47 times more, thus:

Take position on 47 at left of the amount, covering only one figure in machine.

47  
158595

Multiply once, as indicated, then move to the right and multiply 5 times, 8 times, 5 times, etc.

The answer in the register should be 7612560.

The figure in the register hole corresponding to the Right Hand Multiplier Key indicates the number of multiplier strokes to make in each position.

Taking this position at the left of the amount in the register is merely for convenience, the figures in the register then indicate the number of strokes to make.

If you were to commence multiplying at the right of the machine, the figures in the register would be constantly changing so that you would either have to remember the amount in the machine or put it on paper.

### MULTIPLYING THREE FACTORS—Continued

Example:—  $45 \times 267 \times 457$ .

$45 \times 267$  equals 12015 (Let this result stand in the register).

457 less one, equals 456.

Hold 456 with the right hand figure (6) over the left hand figure (1) of 12015, and multiply toward the right 1, 2, 0, 1 and 5 times.

Multiply 456

12015	Answer 5490855.
$345 \times 289 \times 56 =$	5583480
$645 \times 4456 \times 28 =$	80475360
$789 \times 88 \times 546 =$	37909872
$389 \times 673 \times 438 =$	114667086
$6452 \times 344 \times 66 =$	146486208
$75 \times 6489 \times 567 =$	275944725
$33 \times 875 \times 458 =$	13224750
$372 \times 44 \times 8879 =$	145331472

You will find this method very desirable for some feature of the work in nearly every office:—

For instance:—

10 Bolts of Silk @ 69 cts.,  
less  $12\frac{1}{2}\%$

64— $3\frac{1}{4}$  yds.

56—2/

63—1/

62

62

62—1/

65—3/

67—1/

63—2/

64

631.25 yds. @ 69 cts. = \$435.56

less  $12\frac{1}{2}\%$  = 381.12

#### METHOD

Add the yards in the usual manner, leaving the result in the machine, multiply by price per yard (69 cts.), using the 6 8 keys; then multiply by the net of the discount, .875, (as 8 7 4).

Or:—

46 Pc's

132 "

84 "

167 "

34 "

463 " 58 cts. each less 35%

Add the pieces on the right side of Keyboard equals 463.

Leave this in the machine and multiply by .58.

The first key position of course is on 57 at the extreme left of the amount in the machine, e. g.

57

463 result is 268.54

Continuing, take off the discount 35%. The net being 65%, multiply 268.54 by 65—Take the Key position on 64, one less than 65, at the extreme left, e. g.

64

26854

and multiply toward the right in the same manner.

The result is 174.55.

## MULTIPLYING THREE FACTORS—Continued

### METHOD 2

Many times it is easier to hold for the Key Factor the number indicated in the register.

#### Example 1:

8 Reels	53 yards
of Cloth	58 yards
@ $17\frac{1}{4}c$	56 yards
per yard.	61 yards
	63 yards
	56 yards
	54 yards
	66 yards
	<hr/>
	467 yards

### COMPTOMETER METHOD

Add the yards on the right of Keyboard = 467.

We now have 467 yards @ \$.1725 per yard. It is obvious that 467 can be the more easily used as Key Factor. Leave the total of the yardage in the register.

Hold the registered amount **directly over itself** for Key Factor and multiply .1725. Because the Key Factor, 467, is already in the register **once**, multiply only 4 times in the first position, then moving to the left, multiply the remaining figures, .172—, in their respective orders, = \$80.5575.

#### Example 2:

### GLASS FACTORY PAYROLL

Wm. Jones is making some articles that weigh 68 lbs. 8 oz. to the 1000, for which he receives \$1.90 per 1000. He turns in his product several times during the day. A record is kept of it in pounds and ounces.

Several trays brought in weigh, for instance, as follows:

42 lbs.	7 oz.
48 lbs.	6 oz.
47 lbs.	3 oz.
54 lbs.	8 oz.
67 lbs.	14 oz.
<hr/>	<hr/>
260	6

#### Establish a Pound Price:

A pound price is first established from the price and weight per 1000, i. e., add the price per 1000, \$1.90, in the Comptometer at the left and divide by the weight per 1000, 68 lbs. 8 oz., or 68.5 lbs. = \$.02774, price per pound.

Add the ounces, 7, 6, 3, etc., = 38 oz. To convert to pounds you can divide by 16, or, multiply by its Reciprocal, .0625.

#### Using the Reciprocal:

Hold 38 for Key Factor and multiply .0625 towards the left. The multiplier, 38, being in the register **once**, multiply only 4 times in the first position. Point off 4 places = 2.375 lbs. Now continue with the pounds, adding same, 32, 48, etc., in the 5th and 6th columns, equals a total of 260.375 lbs.

The weight, 260.375 lbs., is now in the register, and we will hold same for Key Factor. Split the Key Factor, first holding 26— and multiply .02774 towards the left (multiplying only 3 times in the first position). Upon completing multiplication of 2774 by 26—, move the fingers to the relative keys for .375 and multiply back towards the right.

Or, take the key position on 375 over itself and multiply .02774 towards the left.

Point off 5 additional places for the price, .02774 = \$7.22.

## FIXED DECIMAL MULTIPLICATION

### THE FIXED DECIMAL

This means to **fix the decimal** at a certain place on the machine and do the work so that the decimal is **always at the same place** in the result, regardless of the number of decimals in one or both factors.

This Fixed Decimal multiplication, both in single and accumulated extensions, is used in thousands of Commercial Houses, Railroad Offices, and Manufacturing Plants, for figuring and proving invoices, cost work, pay rolls, etc.

There may be varying decimals in either or both factors but having learned how to use the Fixed Decimal it is easier to make the extensions and it eliminates all the bother and the errors incident to "pointing off."

### METHOD

**Multiplier Key Position:—**

Turn down the Decimal Pointer between the three columns of white and black keys, for the Fixed Decimal division of the Keyboard.

The Keys at the Left will represent Dollars.

Those at the Right of the Decimal, Cents.

Hold the "Price" Keys for the multiplier.

Always take the **original position** directly on the "Price" Keys.

This will be the position to multiply by the **Unit Figure** (first whole number figure) of the quantity.

Thus 4 lbs. of Tea @ 39 cts.

Holding the Price Keys— .39, it is obvious that 4 depressions give the cost of the 4# @ 39 cts. or \$1.56.

If the quantity contains a fraction or decimal as  $4\frac{1}{4}$ # (4.25) Tea @ 39 cts.—

After multiplying by the lbs. (4) move to the **right** and multiply by the decimals 2 and 5 respectively. Answer \$1.6575.



**METHOD—Continued**

If the quantity is **greater** than the unit figure as

34 $\frac{1}{4}$ # (34.25) Tea @ .39  
234 $\frac{1}{4}$ # (234.25) " @ .39

First hold the original "Price" position.

Then move to the left one column for **each additional whole number figure**, i. e., for 34.25 move one column for the 3 and there multiply 3 times, and continue toward the right by the 4, 2, and 5, respectively,—

Answer \$13.3575.

For 234 $\frac{1}{4}$ , first hold the "Price Keys" then move to the left one column for the 3 and again another column for the 2, and there multiply 2 times and continue toward the right, answer \$91.3575.

To **Accumulate**, multiply over the Fixed Decimal and leave each amount in the machine for a final or total result.

4#	@	.39
4 $\frac{1}{4}$	"	.39
34 $\frac{1}{4}$	"	.39
234 $\frac{1}{4}$	"	.39
<hr/>		
\$107.9325		

**EXAMPLE:—**

4 $\frac{3}{4}$	( 4.75)	yards at \$1.25
16 $\frac{1}{2}$	( 16.5 )	yards " .34 $\frac{1}{2}$ c
148 $\frac{1}{4}$	(148.25)	yards " .06 $\frac{1}{4}$ c

Total result \$20.8956+

In problems like the one below, where price consists of 4 or more figures, split the multiplier as indicated.

146	doz.	@	.0368	Doz.
38 $\frac{1}{4}$	"	"	.27	39 "
14 $\frac{1}{4}$	(.417)	"	1.7	25 "

Total result \$40.71872

**PROVING MULTIPLICATION****BY THE NEGATIVE METHOD**

Many times you will find this method of a decided advantage in proving extensions. Especially is this true in Creamery Work and Cost Accounting.

The **Negative Key** position for any multiplier is the Keys bearing the identical amount in **small figures**, but less one, on the right hand **figure of value**, e. g., for 30.99 is 3098. The negative of 38, is Keys with small figures 37,—for 6400 is 63—.

7391    60    34000    4003  

 R. H. Figure of Value.

Example    145 times 38

Multiply in the usual manner from Right to Left equals 5510. Leave this answer in the machine and multiply, in the same manner, 145 by the negative of 38 i. e. small 37. If the original extension was correct the register will now show 14500, or the multiplicand with as many ciphers to the right as there are figures in the multiplier.

This method of proof is positive, since compensating errors in the original extension and the proof are impossible.

We first multiplied 145×38.

Then, in the negative, actually multiplied 145×62.

Thus, all told, we multiplied 145×100.

Therefore, must have 14500 in the register.

## SUBTRACTION

Subtraction on the Comptometer is as **practical** and **simple** as Addition. In deducting an amount, use the **small figures** on the key tops and the Subtraction Cut-Off.

The reason for using the small figures in Subtraction is to be found in the following:

The Complement of a number is that number which, added to it, will make 10 or some power of 10, e. g.—

The Complement of	3	of	195
is	<u>7</u>	is	<u>805</u>
	10		1000
of	13	of	1203
is	<u>87</u>	is	<u>8797</u>
	100		10000

In each case, you will see that the two right hand figures, added, make 10, while all of the other columns, separately, equal 9. This is because the one carried from the first column continues to the end of the Complement.

It is a well known mathematical principle that adding the Complement of one number to another will by eliminating the carrying at the left, give the same result as making an actual subtraction.

e. g.			
368		368 +	(The Complement of 127
-127	(Eliminating the carrying)	<u>873</u>	is) <u>873</u>
241		241	1000

You will notice that the small and large figures on the key tops are all complementary to the figure 9; therefore, the key of one less, for the **right hand figure of value**, in the small figures, will add one more, thus making the full complement.

The Column Cut-Offs eliminate the carrying, while the operation of the keys bearing the small figures of the subtrahend performs the subtraction, using the key of one less for the right hand figure of value.

To subtract one number from another, put the **larger amount** (minuend) in the machine as in adding.

In subtracting the smaller amount, (subtrahend), use the corresponding **small figures**, excepting for the right hand figure of value, which must be **one less**, i. e., to subtract 28 use the small figures 2 7.

Subtract 28 from 1036.

### METHOD

Add 1036 on the right side of keyboard.

Cover the Register with the **left hand**, then move it to the left until there is visible **an amount greater** than the 28 to be subtracted. At this point, push and hold back the Subtraction Cut-Off immediately to the left of the amount visible, e. g., 10|36.

**METHOD—Continued**

With the right hand, push the keys bearing the **small figures 27**; the result shown is 1008.

Now subtract 36 from 1008—locate the Cut Off in the same manner—you find in this case there are two more columns of Keys **at the right** of the Cut Off than there are numbers in the amount to be subtracted.

In all cases of this kind use the Keys bearing the small cipher (0) in each of these additional columns, i. e., push down the small 0-0-3-5 Keys—your result is 972.

**NOTE 1.**—Always use **one less** for the **right hand figure of value**.

7391    60    34000    4003  
 R. H. Figure of Value.

For subtracting 127 use 126 keys in **small figures**  
 " " 209 " 208 " " " "  
 " " 200 " 1— " " " "  
 " " 301 " 300 " " " "

**NOTE 2.**—Where 9 occurs, pass that column (as there are no Keys bearing the small 9). If, however, it be the right hand figure of value it becomes 8 owing to the one less—

For subtracting 1987 use 1-86 in **small figures**  
 " " 980 " -7- " " "  
 " " 999 " -8 " " "  
 " " 1009 " 1008 " " "  
 " " 901 " -00 " " "

In the following examples the vertical line indicates the cut-off to hold back.

Use <b>small figures</b>	2 143—127	126 Ans. 2016
" " "	1 7036—209	0208 Ans. 16827
" " "	1 0030—301	00300 Ans. 9729
" " "	1 2326—1987	1—86 Ans. 10339
" " "	1 080—980	0—7— Ans. 100
" " "	1 126—999	0—8 Ans. 127
" " "	1 026—1009	1008 Ans. 17
" " "	2 00326—901	000—00 Ans. 199425

**NEGATIVE SUBTRACTION**

Negative Subtraction is determining the difference between two factors when the smaller amount is in the Register. This would only be occasioned by some previous total or calculation which leaves the smaller amount in the Register; for instance, determining the Interstate Revenue from Conductor's Cash Collections.

**EXAMPLE:**

The Conductor turns in his report of Cash Collections, on which he has made the original footing; the Auditing Office must determine the revenue in Alabama and Georgia.

**METHOD**

Add the items of revenue for Alabama . .	\$10.33	\$1.45 Alabama
leaving the amount in the machine.		3.72 "
Subtract the total . .	18.06	5.16 "
in the usual manner.		.33 Georgia
Inasmuch as we are taking a large amount from a smaller, the answer, 9227, must be a <b>Negative</b> .		.24 "
The Negative of 9227 is <b>small</b>		2.25 "
figures 226 and the revenue for Georgia is represented by the large figures on these keys.		1.37 "
		1.40 "
		.33 "
		.24 "
		1.57 "

**\$18.06**

To register the actual amount, or **Positive**:

Hold back the Cut-Off at the left of the amount in the machine and add each negative key—small 2-2 and 6 twice, registers the difference, \$7.73.

## COMPOUND SUBTRACTION

**This is subtracting the unknown product of two numbers.**

Equations of this nature are found more particularly in the Engineering Work.

**EXAMPLE:**

$$(436 \times 54) - (37 \times 163)$$

### METHOD

Multiply  $436 \times 54$  at right of Keyboard. . . . = 23544

Leave this result in the Register and multiply  $37 \times 163$  **negatively**, i. e., hold at the right of Keyboard the negative of 37 (small 36) and multiply 163—Now subtract the multiplicand plus as many ciphers as **there are** figures in the multiplier you have just used, i. e., 16300. . . . . = 17513

**Or Better—**

After multiplying  $436 \times 54$  and with 23544 in the register, hold 37 negatively at the right and multiply 163. As you complete the multiplication of the last figure, merely move to the left **one column** and there commence to subtract the multiplicand, 163 = 17513

Thus, with the product of the two larger numbers in the register, the subtracting of the unknown product of two numbers, as  $37 \times 163$ , actually amounts to the following operation:

Adding  $*63 \times 163$

and subtracting  $100 \times 163$

Hence the net amount subtracted is  $37 \times 163$ .

\* Negative of 37.

### FINDING THE DIFFERENCE BETWEEN THE SQUARES OF TWO NUMBERS

**EXAMPLE:**

$$\sqrt{687^2 - 236^2}$$

Square 687 on right of Keyboard. . . . . = 471969

Leave this in the register and directly over it, square 236, **negatively**, i. e., hold the negative of 236 (small 235), and multiply 236. As you complete the multiplication, move to the left **one column** and then subtract 236. . . . . 652273

—236

= 416273

Extract the Square Root. . . . . = 645.192 Ans.

("See Square Root" for method)

## DIVISION

The process of Division on the Comptometer is a very simple one, successive key depressions only being required.

The Comptometer itself indicates when the division of each Active Dividend is complete, thus rendering unnecessary the estimating of the Quotient figure.

### THE CO-DIGITS

The **small figures** on the key-tops are the Co-Digits of the large ones, which are the Digits.

In performing division or subtraction the co-digits on the key-tops indicate the keys to be operated and are referred to either as "Co-Digits" or "Small Figures."

The arithmetical principle on which the use of the co-digits is based is explained in the appendix to Operating Instructions.

When depressing the keys according to the co-digits, always use the key of one less for the **right-hand significant figure**.

When the number to be depressed according to the co-digits has a cipher or ciphers on the right, such ciphers must be disregarded. When the ciphers occur between the other figures, these co-digit ciphers must be depressed.

### DIVISION TERMS

375408 divided by 44 = 8532

**Dividend:** The number to be divided, (375408).

**Divisor:** The number to divide by, (44).

**Active Dividend:** The first figures in the Dividend that will contain the Divisor, e. g., in the above Dividend, 375 will **first contain** the Divisor 44; therefore, it is the first **Active Dividend**.

**Changing Quotient:** Is that cipher or figure in the Register Hole **one place to the left** of the Divisor Key Position, e. g., in this problem, the first **Changing Quotient** is 3.

**Divisor Keys:** The **Small Figures** corresponding to the Divisor, excepting for the **Right-Hand Figure of Value**, which must be **one (1) less**, e. g., with a Divisor 44, use Small Figures 43.

7391    60    34000    4003    Right Hand Significant  

 Figure,—Or  
 R. H. Figure of Value.

For Divisor	12,	use small figures,	or Co-Digits	11,
" "	32	" "	" "	31,
" "	56	" "	" "	55,
" "	60	" "	" "	5-
" "	144	" "	" "	143,
" "	2240	" "	" "	223-

Where 9 occurs in the Divisors, pass that column (as there are no keys bearing the small 9). If, however, it be the right-hand figure of value, it becomes 8, owing to one (1) less.

For Divisor	209,	use small figures,	or Co-Digits	208,
" "	1987	" "	" "	1-86,
" "	96	" "	" "	-5,
" "	980	" "	" "	-7-
" "	901	" "	" "	-00,
" "	999	" "	" "	-8,

## DIVISION INSTRUCTIONS

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**EXAMPLE:** Divide 375408 by 44.

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### METHOD

Add the **Dividend** into the machine fr

**1st:** Place the fingers on the Divisor  
over the first **Active Dividend**, units

44 first divides into 375, which is, therefore,  
Dividend. The Key Position then is on **small 43**

**2nd:** Look at the **Changing Quotient**

**3rd:** Depress the Divisor Keys repeatedly, count-  
ing the strokes aloud

Continued on next Page.

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## **DIVISION METHOD—C**

until the last number comes  
with the Changing Quotient.

The Changing Quotient starts with  
depress the Divisor Keys repeatedly, it  
becomes 4, then 5, then 6 and 7. When  
counted seven key depressions the Quo-  
tient showing 7, accords with the number  
depressions.

### **4th. Look at the Remainder**

Without moving the Finger Position  
depress the same Divisor Keys until  
the Remainder becomes less than  
the Divisor.

In this case the Remainder is 67. One more  
Divisor depression and the Remainder becomes 23,  
which is less than the Divisor 44.

Continued on next Page.

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The f  
8 is the  
23 the R  
order wi  
dend.

Move  
one colu

Look  
in the s  
is now 2

Depress the Divisor keys repeatedly, **count** and **watch** the **Changing Quotient**, as before. On the fourth depression, the **number counted** and the **Quotient** become identical.

Look at the Remainder, (58) and reduce as before (Until it becomes less than the Divisor).

This completes the second operation.

Move one column to the right, to the next Divisor position and continue as before.

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Continued on next Page.



Make key depressions (1 key depr.) and count against the **Changing Quotient**. In the above, as occasionally occurs, the full number of depressions are made without increasing the **Changing Quotient**.

Reduce the **Remainder** (96), two depressions being required, when the remainder becomes 8.

Move to the right for the next **Divisor Position**.

The **Changing Quotient** is now 0; therefore, it is only necessary to reduce the **Remainder** (88) depressing twice,—

when the answer is.....8532

(Continued on following page.)

**POINTING OFF**

3754.08 divided by 44.

1st. Add the Dividend in from the left of the machine.

2d. Turn down the Decimal Point, the **same as on paper**, thus 3754.08.

3d. Move the Decimal to the left as many places as there are **whole** numbers in the Divisor; e. g., the Divisor 44 contains two whole numbers; therefore, move the decimal two places, i. e., between 7 and 5, as 37.5408.

**PROVING DIVISION****EXAMPLE:**

Sales \$366.00—Profit \$67.80—What is the per cent of Profit?

$$67.80 \div 366 = 18\% (192 \text{ Rem}).$$

**METHOD 1**

The simple proof, when the Division is completed,—

Jot down the Quotient and Remainder.

Clear the machine.

Multiply the Quotient by the Divisor,

$$366 \times .18 \dots\dots\dots \$65.88$$

$$\text{Add in the Remainder} \dots\dots\dots 1.92$$

$$\text{Equals the Dividend} \dots\dots\dots \$67.80$$

**DIVISION CORRECTION**

If the Divisor Keys have been depressed **once more than they should have been**,—

You have merely deducted the Divisor once more than you should have, so hold back the Cut-Off **just at the left of the Divisor Keys** and **add** (in large figures) the amount of the actual Divisor.

**EXAMPLE:**

$$375408 \div 44 = 8532$$

With the Dividend in the machine, and Key Position on the Divisor, (small 43), depress the keys until the Changing Quotient and Key Depressions agree.

The Remainder is 67. In reducing, depress the Divisor keys purposely once too often (twice). The Remainder showing is 79.

Hold back the Cut-Off at the left of 79 and, directly over 79 **add** 44, giving the result 23, the correct Remainder.

## DIVISION POINTERS

Add the Dividend in the machine from the left, pointing off before dividing. Count key depressions, against the Changing Quotient, reduce Remainder, move to new position, etc.

Divisor Positions are always on the **Small Figures**, with the Key **one less** for the Right Hand Figure of Value.

1st: Count key depressions against Changing Quotient;

2nd: Reduce Remainder;

3rd: Move to new position, etc.

When the Changing Quotient is a cipher, simply reduce the Remainder.

Ciphers at the right of the Divisor are eliminated except in pointing off.

Ciphers in the body of the Divisor are held the same as other keys.

When 9 occurs in the Divisor, (excepting the R. H. Fig. of Value), no key is held for that position.

### LONG DIVISOR

Split the Divisor when it cannot be easily held at one time. Divide in each new position with the first part of the Divisor; then, with the right hand, immediately depress the unused Divisor Keys the same number of times, (as indicated by the Quotient figure).

Let the left hand retain the Key Place, the right hand depress the unused Divisor Keys and then return to its original keys, as the Remainder may become sufficiently large to contain the entire Divisor once more.

EXAMPLE:

$$6750 \div 18744$$

Add the Dividend in the machine from the left.

Pull down the decimal pointer at the right of 6750. Now point off to the left as many places as there are whole numbers in the divisor, which are 5. This brings the decimal point at the left end of the register.

Take position on 187, with both hands, and reduce—(three times).

Then, the right hand leaves its position, to depress the unused Divisor Keys, small 43, in the neighboring columns, (three times). The finger of the left hand **retains its Key Position** while the thumb covers the 87 keys merely for the convenience of the right hand in coming back to its original position.

Return right hand to the original position. The Remainder will not contain the Divisor again; therefore, move to the right and count against the Changing Quotient.

Then, depress the remaining Divisor Keys accordingly, and return to the former position. The Divisor is **now contained once more**, so depress again the original 187 and then the remaining Divisor Keys 43. Move to the right. 187 will not contain, so move to next position and reduce, etc.

Answer..... 3601, Remainder 2856

## METHOD 2—LONG DIVISORS

In the foregoing example we used two of the divisor keys to first obtain a quotient figure, after which we depressed the keys for the negative of the **unused divisor** as many times as indicated by the quotient figure.

By this method, we will obtain the quotient figure in the same manner and then depress the **quotient digit** (large) in each of the unused divisor columns as many times as indicated by the **negative** of the **unused divisor** figures.

In order to make the proper number of key depressions, it will be found easier to count from each divisor figure, inclusive, up to 8, depressing the key with each count. For the right-hand significant figure, count to 9.

**Rule.**—Find a quotient figure by using the two left-hand figures of the divisor, and then, on the row of keys on which the "digit" (large figure) is the same as the quotient figure, depress, for each of the remaining figures of the divisor, as follows: suppose a remaining divisor figure to be 6, count "six, seven, eight," depressing the key each time, which of course is three times altogether. Or, suppose the remaining divisor figure is 4, count "four, five, six, seven, eight." Always start counting with the figure and stop at eight, except for the extreme right-hand figure, which must be depressed once extra.

**Example:**— $90892150 \div 3567648$ .

Adding the dividend in the Comptometer at the left and then using 35 (on the co-digits, but not one less) as a trial divisor, two key depressions show that the first quotient figure is 2; therefore leave the left-hand finger on the key to keep the place and move the right-hand finger one column to the right onto the large 2 key. The first of the remaining figures of the divisor (67648) being 6, count thus: "six, seven, eight," depressing the key with each count; (the next "remaining" figure being 7) move to the next 2 key, and count "seven, eight," depressing with each count; move one key to the right and count "six, seven, eight," depressing with each count; move one key to the right and count: "four, five, six, seven, eight," move one key to the right and this being the last figure count: "eight, nine," depressing the keys with each count when the Register shows 2 as first quotient figure and 1,953,919 remainder.

Again using the two left-hand figures as a trial divisor we find that the second quotient figure is 5, so put the right-hand finger on the large 5, one column to the right and count: "six, seven, eight," move to the right and count: "seven, eight," and so on for each of the remaining figures of the divisor, when pointing off we have  $25 + 1700950$ , that is, final quotient 25 and remainder of 1,700,950.

It will be seen that, if desired, the quotient can be carried out decimally. To carry the quotient out decimally on an eight-column machine, one figure on the right of the divisor will be dropped as each decimal figure is obtained. But in the examples just illustrated this dropping of figures of the divisor will not make any difference in the answer until the fourth decimal place of the quotient is reached.

**Notes.**—If either of the two left-hand figures of the divisor be 9, use the first three figures as a trial divisor, because that column in which 9 stands does not have to be operated.

If any of the "remaining" figures of the divisor be 9, of course no count of key depressions is made for it unless it is the units figure (last figure) of the divisor, when one key depression is made.

If there be a naught (0) among the remaining figures of the divisor, count "naught, one, two, three," etc., just the same as for any figure.

In obtaining a quotient figure with the trial divisor it sometimes occurs that the remainder resulting from dividing by the trial divisor nearly equals the trial divisor, and that depressing Quotient Digit Keys for the "remaining" figures of the divisor increases the remainder until it becomes as great or greater than the trial divisor. In such cases depress the first two divisor keys once more; then depress on the row of one keys for each of the remaining figures of the divisor, as before—

Or—

Depress the entire divisor keys according to the Co-Digits. Either process will increase the quotient figure by one and decrease the remainder.

## CIPHER METHOD DIVISION

This is a method of Division that is very practical for small Divisors. It necessitates **holding one more key** than the regular Division method.

Its advantage to the beginner is that there is only one thing to do,—reduce; i. e., Depress the Divisor Keys repeatedly until the **Active Dividend becomes less than the Divisor**.

### EXAMPLE:

$$884325 \div 65 = 13605$$

Add the Dividend in the machine **one column from the left**.

Hold and operate, with the regular Divisor Keys, the small cipher key at their left, i. e., small o 6 4,—holding the o key with the left hand and the 64 with the right.

The first position is over 088.

Depress these three keys until the Active Dividend, 88, becomes less than the Divisor, 64.

(One depression when the Remainder is only 23.)

Move to the right for new Divisor Position.

234 is now the Active Dividend.

Reduce until it becomes less than the Divisor.

(When the Remainder becomes 39.)

Move for new Divisor Position.

393 is the new Active Dividend.

Reduce again, watching only the Active Dividend until it becomes less than the Divisor, 65.

(The Remainder becomes 3.)

Continue in this manner until the Division is completed. Answer, 13605.

When using this method with larger Divisors, split the Divisor. Reduce with the first two or three figures of the Divisor, then immediately depress the remaining Divisor keys a corresponding number of times for each Active Divisor.

CARD HOLDER IN USE HOLDING RECIPROCAL TABLE

## DIVISION BY USE OF THE RECIPROCAL

A great deal of Percentage Work, Unit Costs, Averaging, etc., can be worked up with the "Reciprocal" to a decided advantage.

### THE "RECIPROCAL"

A Reciprocal of any Divisor is that decimal produced by dividing it into 1 and by which we can multiply and get the same result as though performing an actual division.

#### EXAMPLE:

Divide 32 by 8  
 " 48 by 8  
 " 63 by 8

8 divided into 1 equals .125, or, looking opposite 8 on the "Reciprocal Card," is .125. 32 multiplied by .125 equals 4; therefore—

$$\begin{aligned} 32 \div 8 &= 32 \times .125 = 4 \\ 48 \div 8 &= 48 \times .125 = 6 \\ 63 \div 8 &= 63 \times .125 = 7.875 \end{aligned}$$

### POINTING OFF WHEN MULTIPLYING BY "RECIPROCALLS"

Multiplying from the left of the Keyboard.

Turn down the first decimal pointer at the left of the machine.

If the **Divisor** is **greater** than the dividend, the decimal point will be as many places to the left of this pointer as the whole numbers of the divisor exceed those in the dividend.

If the **Dividend** is **greater** than the divisor, the decimal point will be as many places to the right of this pointer as the whole numbers in the dividend exceed those in the divisor.

## For Calculations Where the Divisor Is Constant, Use the Following Method:

Determine the Reciprocal of the Divisor, i. e., divide the Divisor into 1.

#### EXAMPLE:

The departmental costs for manufacturing 356 articles are as follows:

	Cost	Costs Each	% Each Department
Labor	582.55	1.6364	.446
Wood Working	284.37	.7988	.217
Painting	175.92	.4942	.135
Foundry & Shop	263.70	.7407	.202
	1306.54	3.6701	1.000

What is the cost per article in each department?

What is the per cent of Cost in each department, to the third decimal?

#### Unit Cost:

Each cost item must be divided by 356, the number of pieces.

356 divided into 1 = .002809, the "Reciprocal."

$$582.55 \times 2809 = 1.6364$$

Multiply from the extreme left of the Keyboard.

Pull down the left Decimal Pointer.

The Divisor, 356, contains 3 whole numbers.

" Dividend, 582.55, " " " " so the decimal remains at the same place in the answer.

#### Department %

1306.54, as 1307, divided into 1 = 7651 Reciprocal.

$$582.55 \times 7651 = .446\%$$

The Divisor, 1307, contains 4 figures.

" Dividend, 582.55, " 3 "

Therefore, the decimal is one place to the left.

In like manner, determine the Unit Cost and per cent of each. Prove each result by Negative Multiplication, or the final total of results by multiplying the total costs by the Reciprocals.

**Note:** Hereafter, in referring to Reciprocals, the decimal point will not always be shown, inasmuch as its location, in the Comptometer Method outlined, depends entirely upon the relation of the Dividend and Divisor.

### SOME USES FOR THE RECIPROCAL PROFIT AND LOSS

SALESMAN	DEPT. #1			DEPT. #2			DEPT. #3			TOTAL		
	SALES	PROFIT	%	SALES	PROFIT	%	SALES	PROFIT	%	SALES	PROFIT	%
<i>John Avis</i>	14625	3240	22.2	11320	2645	23.4	8738	1624	18.6	34583	7509	21.7
<i>W. J. Orr</i>	25395	6732	26.5	8675	1920	22.1	11476	2182	19.0	45546	10834	23.8
<i>Abel Wicks</i>	9450	786	8.3	7543	1240	16.4	6270	1238	19.7	23263	3264	14.0
<i>Jno. Scanlon</i>	16700	3240	19.4	12435	2860	23.	9348	2316	24.8	38483	8416	21.9
	66170	13998	21.1	39973	8665	21.7	35832	7360	20.5	141975	30023	21.1

Here you figure the per cent of profit through each salesman in each department.

The per cent of profit is figured on the **selling price**. To get per cent of profit, divide the profit by the amount of sales.

The first four figures of Reciprocal will be ample to use on this class of work.

In each case when the amount of sale is less than \$100.00 use the Reciprocal for the three highest figures and this practice is recommended in all similar cases. For instance: Take the sales in Dept. 1 for Abel Wicks, 94.50. Use the Reciprocal for 945, 1058 and multiply the profit, 7.86, obtaining the per cent, .083.

When the amount of sale is \$100.00 or over, disregard the cents under 50; but where 50c or more, treat as a whole dollar.

For convenience, place the Reciprocal Card in a holder on the back part of the Comptometer.

For easily finding the Reciprocals, locate the **hundreds** column by the Bold Face figures at top of Table; the **tens** by the Bold Face figures at the left side of Table.

#### METHOD

Figure the per cent to the **third decimal place** and consider the remainder, in order to accurately determine the last figure.

	Sales	Profit
Dept. 1, Avis' .....	\$146.25	\$32.40
Hold the profit, 324, for Key Factor, at the left of Keyboard, and multiply the Reciprocal opposite 146, i. e., 6849+, equals.. 22.2%		

#### POINTING OFF

Multiply from the left of Keyboard. Pull down the left decimal pointer. The divisor contains one more whole number than the dividend; so the decimal in answer is one place to the left.





	1100	1200	1300	1400	1500	1600	1700	1800	1900
1001	99900	1201	99833	1301	70623	1401	71129	1501	69697
1002	99900	1202	99834	1401	71378	1501	69697	1601	69697
1003	99900	1203	99835	1402	71627	1502	69698	1602	69698
1004	99901	1204	99836	1403	71876	1503	69699	1603	69699
1005	99902	1205	99837	1404	72125	1504	69700	1604	69700
1006	99903	1206	99838	1405	72374	1505	69701	1605	69701
1007	99904	1207	99839	1406	72623	1506	69702	1606	69702
1008	99905	1208	99840	1407	72872	1507	69703	1607	69703
1009	99906	1209	99841	1408	73121	1508	69704	1608	69704
1010	99907	1210	99842	1409	73370	1509	69705	1609	69705
1011	99908	1211	99843	1410	73619	1510	69706	1610	69706
1012	99909	1212	99844	1411	73868	1511	69707	1611	69707
1013	99910	1213	99845	1412	74117	1512	69708	1612	69708
1014	99911	1214	99846	1413	74366	1513	69709	1613	69709
1015	99912	1215	99847	1414	74615	1514	69710	1614	69710
1016	99913	1216	99848	1415	74864	1515	69711	1615	69711
1017	99914	1217	99849	1416	75113	1516	69712	1616	69712
1018	99915	1218	99850	1417	75362	1517	69713	1617	69713
1019	99916	1219	99851	1418	75611	1518	69714	1618	69714
1020	99917	1220	99852	1419	75860	1519	69715	1619	69715
1021	99918	1221	99853	1420	76109	1520	69716	1620	69716
1022	99919	1222	99854	1421	76358	1521	69717	1621	69717
1023	99920	1223	99855	1422	76607	1522	69718	1622	69718
1024	99921	1224	99856	1423	76856	1523	69719	1623	69719
1025	99922	1225	99857	1424	77105	1524	69720	1624	69720
1026	99923	1226	99858	1425	77354	1525	69721	1625	69721
1027	99924	1227	99859	1426	77603	1526	69722	1626	69722
1028	99925	1228	99860	1427	77852	1527	69723	1627	69723
1029	99926	1229	99861	1428	78101	1528	69724	1628	69724
1030	99927	1230	99862	1429	78350	1529	69725	1629	69725
1031	99928	1231	99863	1430	78599	1530	69726	1630	69726
1032	99929	1232	99864	1431	78848	1531	69727	1631	69727
1033	99930	1233	99865	1432	79097	1532	69728	1632	69728
1034	99931	1234	99866	1433	79346	1533	69729	1633	69729
1035	99932	1235	99867	1434	79595	1534	69730	1634	69730
1036	99933	1236	99868	1435	79844	1535	69731	1635	69731
1037	99934	1237	99869	1436	80093	1536	69732	1636	69732
1038	99935	1238	99870	1437	80342	1537	69733	1637	69733
1039	99936	1239	99871	1438	80591	1538	69734	1638	69734
1040	99937	1240	99872	1439	80840	1539	69735	1639	69735
1041	99938	1241	99873	1440	81089	1540	69736	1640	69736
1042	99939	1242	99874	1441	81338	1541	69737	1641	69737
1043	99940	1243	99875	1442	81587	1542	69738	1642	69738
1044	99941	1244	99876	1443	81836	1543	69739	1643	69739
1045	99942	1245	99877	1444	82085	1544	69740	1644	69740
1046	99943	1246	99878	1445	82334	1545	69741	1645	69741
1047	99944	1247	99879	1446	82583	1546	69742	1646	69742
1048	99945	1248	99880	1447	82832	1547	69743	1647	69743
1049	99946	1249	99881	1448	83081	1548	69744	1648	69744
1050	99947	1250	99882	1449	83330	1549	69745	1649	69745
1051	99948	1251	99883	1450	83579	1550	69746	1650	69746
1052	99949	1252	99884	1451	83828	1551	69747	1651	69747
1053	99950	1253	99885	1452	84077	1552	69748	1652	69748
1054	99951	1254	99886	1453	84326	1553	69749	1653	69749
1055	99952	1255	99887	1454	84575	1554	69750	1654	69750
1056	99953	1256	99888	1455	84824	1555	69751	1655	69751
1057	99954	1257	99889	1456	85073	1556	69752	1656	69752
1058	99955	1258	99890	1457	85322	1557	69753	1657	69753
1059	99956	1259	99891	1458	85571	1558	69754	1658	69754
1060	99957	1260	99892	1459	85820	1559	69755	1659	69755
1061	99958	1261	99893	1460	86069	1560	69756	1660	69756
1062	99959	1262	99894	1461	86318	1561	69757	1661	69757
1063	99960	1263	99895	1462	86567	1562	69758	1662	69758
1064	99961	1264	99896	1463	86816	1563	69759	1663	69759
1065	99962	1265	99897	1464	87065	1564	69760	1664	69760
1066	99963	1266	99898	1465	87314	1565	69761	1665	69761
1067	99964	1267	99899	1466	87563	1566	69762	1666	69762
1068	99965	1268	99900	1467	87812	1567	69763	1667	69763
1069	99966	1269	99901	1468	88061	1568	69764	1668	69764
1070	99967	1270	99902	1469	88310	1569	69765	1669	69765
1071	99968	1271	99903	1470	88559	1570	69766	1670	69766
1072	99969	1272	99904	1471	88808	1571	69767	1671	69767
1073	99970	1273	99905	1472	89057	1572	69768	1672	69768
1074	99971	1274	99906	1473	89306	1573	69769	1673	69769
1075	99972	1275	99907	1474	89555	1574	69770	1674	69770
1076	99973	1276	99908	1475	89804	1575	69771	1675	69771
1077	99974	1277	99909	1476	90053	1576	69772	1676	69772
1078	99975	1278	99910	1477	90302	1577	69773	1677	69773
1079	99976	1279	99911	1478	90551	1578	69774	1678	69774
1080	99977	1280	99912	1479	90800	1579	69775	1679	69775
1081	99978	1281	99913	1480	91049	1580	69776	1680	69776
1082	99979	1282	99914	1481	91298	1581	69777	1681	69777
1083	99980	1283	99915	1482	91547	1582	69778	1682	69778
1084	99981	1284	99916	1483	91796	1583	69779	1683	69779
1085	99982	1285	99917	1484	92045	1584	69780	1684	69780
1086	99983	1286	99918	1485	92294	1585	69781	1685	69781
1087	99984	1287	99919	1486	92543	1586	69782	1686	69782
1088	99985	1288	99920	1487	92792	1587	69783	1687	69783
1089	99986	1289	99921	1488	93041	1588	69784	1688	69784
1090	99987	1290	99922	1489	93290	1589	69785	1689	69785
1091	99988	1291	99923	1490	93539	1590	69786	1690	69786
1092	99989	1292	99924	1491	93788	1591	69787	1691	69787
1093	99990	1293	99925	1492	94037	1592	69788	1692	69788
1094	99991	1294	99926	1493	94286	1593	69789	1693	69789
1095	99992	1295	99927	1494	94535	1594	69790	1694	69790
1096	99993	1296	99928	1495	94784	1595	69791	1695	69791
1097	99994	1297	99929	1496	95033	1596	69792	1696	69792
1098	99995	1298	99930	1497	95282	1597	69793	1697	69793
1099	99996	1299	99931	1498	95531	1598	69794	1698	69794
1100	99997	1300	99932	1499	95780	1599	69795	1699	69795

COMPTOMETER RECIPROCAL CARD—Continued—1001 to 2000

## SQUARE ROOT

Square Root involves a process of Division, where in the Divisor changes with each period. The **Unit Figure** of the Divisor is at first unknown. It is determined by the **number of times the known part of the Divisor is contained** in each Active Dividend.

### EXAMPLE 1:

Extract the Square Root of 753,090.24.

#### METHOD

Add the amount in the Comptometer at the left and point off from the decimal in two figure periods, as  
75'30'90'24.

#### First Period—75:

Determine the root mentally, equals 8.

Divide 8 into this period eight times.

Use the small cipher Key with the Divisor Key (i.e. small 07 Keys).

8 is recorded for the First Root Figure; set it off with decimal pointer and throw the remainder, 11, with the next period.

If the first, or mentally determined, Root Figure is 5 or more, use the small cipher next on the left with the Divisor. Otherwise the Divisor key is used as in regular division.

#### Second Period—1130:

Double the Found Root, equals 16.

Hold small 16 as the known Divisor and divide into 113—. It is contained six times; therefore six becomes the **Unit Figure** of the Divisor.

Depress its negative (small 5 over the naught) accordingly six times.

Set off the two Root Figures, 86, with the decimal pointer, and throw the balance with the next period.

#### Third Period—13,490:

Double the Found Root, 86, equals 172, the Known Divisor, and divide it into 1349. It goes 7 times; therefore 7 is the Unit Figure of Divisor and depress its negative (small 6) 7 times.

The Root is now 867, and Remainder 1401, which is thrown into the next period.

#### Fourth Period—140124:

Double the Found Root, 867, =1734, and divide it into 14012—. It goes 8 times; so depress the negative (small 7) a corresponding number of times (8) = Square Root, 867.8 and a Remainder, 1340.

### EXAMPLE 2:

Extract the Square Root of 126,736.

Add 126736 in the machine at the left and point off from the decimal point, in periods of two figures each, as—  
12'67'36

#### First Period—12:

(Mentally) The Square Root is 3; therefore divide by three three times equals the first Root, 3, and leaves a remainder of 3. Set off the root with decimal pointer and throw the remainder with the next period.

#### Second Period—367:

Double the Found Root, equals 6 and divide it into 36—it goes 5 times; so depress the negative (small 4 over 7) five times, equals Found Root of 35 and leaves 42, Remainder. Set off the Obtained Root, 35, with Decimal Pointer and throw the Remainder, 42, with the next period.

#### Third Period—4236:

Double the Found Root equals 70.

Divide it (small 70) into 423— = 5.

Complete the division with 5 as the Unit Figure (small 4) equals 355 Root and 711, Remainder.

It is obvious the Divisor, 705, would contain in this Remainder once more; therefore find the new Divisor, i. e. merely double the Complete Found Root, 355, equals 710. (\*) Then use small 710 as actual Keys for Divisor and make one depression, when answer is 356, the Square Root.

(\*) We know by inspection that this will divide once. Therefore the Divisor will be 711 and its negative, small 710.

## CUBE ROOT WITH THE COMPTOMETER

In connection with the tables herewith given.

**EXAMPLE:**

Find the Cube Root of 49,568,518.

**METHOD**

Add 49,568,518 in the Comptometer at the left. Turn down the decimal pointer and from it point off in three figure periods, as:

49'568'518.

**First Period—49.**

Refer to the accumulation column and find the nearest accumulation less than 49. This is 27, and opposite it is 3, the Root No. Subtract the accumulation, 27, from this period, 49. Jot down 3 as the first root figure obtained.

Throw the remainder into the next period.

**Second Period—22'568.**

Annex 1 to the Obtained Root Figure, =31.

Now beyond No. 31, find the nearest accumulation less than 22,568, which is 19,656 and opposite, Root No. 36. Subtract the accumulation and jot down 6 as the second Root Figure.

Throw the remainder with the next period.

**Third Period—2,912,518.**

Annex 1 to the Obtained Root =361.

Find the first accumulation beyond 361 and nearest this period. It is 2,774,863, and opposite it is 367, the Root Number. Again subtract the accumulation and jot down 7 as the third Root Figure. The first three figures of the Root are 367.

**To secure the Root of the Remainder.**

Opposite Root Number 367 is Divisor 402,967.

Divide this into the remainder, 137'655, until the approximate figures, 342, are obtained.

The required Root then is 367.342.

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## CUBE ROOT TABLES

No.	Divisor	Accumulation	No.	Divisor	Accumulation	No.	Divisor	Accumulation	No.	Divisor	Accumulation
1	1	1	51	7,651	7,651	101	30,301	30,301	151	67,951	67,951
2	7	8	52	7,957	15,608	102	30,907	61,208	152	68,857	136,808
3	19	27	53	8,269	23,877	103	31,519	92,727	153	69,769	206,577
4	37	64	54	8,587	32,464	104	32,137	124,864	154	70,687	277,264
5	61	125	55	8,911	41,375	105	32,761	157,625	155	71,611	348,875
6	91	216	56	9,241	50,616	106	33,391	191,016	156	72,541	421,416
7	127	343	57	9,577	60,193	107	34,027	225,043	157	73,477	494,893
8	169	512	58	9,919	70,112	108	34,669	259,712	158	74,419	569,512
9	217	729	59	10,267	80,379	109	35,317	295,029	159	75,367	644,679
10	271	1,000	60	10,621	91,000	110	35,971	331,000	160	76,321	721,000
11	331	331	61	10,981	10,981	111	36,631	36,631	161	77,281	77,281
12	397	738	62	11,347	22,528	112	37,297	73,928	162	78,247	155,528
13	469	1,197	63	11,719	34,047	113	37,969	111,897	163	79,219	234,747
14	547	1,744	64	12,097	46,144	114	38,647	150,544	164	80,197	314,944
15	631	2,375	65	12,481	58,625	115	39,331	189,875	165	81,161	396,125
16	721	3,096	66	12,871	71,496	116	40,021	229,896	166	82,171	478,296
17	817	3,913	67	13,267	84,763	117	40,717	270,613	167	83,167	561,463
18	919	4,832	68	13,669	98,432	118	41,419	312,032	168	84,169	645,632
19	1,027	5,859	69	14,077	112,509	119	42,127	354,159	169	85,177	730,809
20	1,141	7,000	70	14,491	127,000	120	42,841	397,000	170	86,191	817,000
21	1,261	1,261	71	14,911	14,911	121	43,561	43,561	171	87,211	87,211
22	1,387	2,648	72	15,337	30,848	122	44,287	87,848	172	88,237	175,448
23	1,519	4,167	73	15,769	46,017	123	45,019	132,867	173	89,269	264,717
24	1,657	5,824	74	16,207	62,224	124	45,757	178,624	174	90,307	355,024
25	1,801	7,625	75	16,651	78,875	125	46,501	225,125	175	91,351	446,375
26	1,951	9,576	76	17,101	95,976	126	47,251	272,376	176	92,401	538,776
27	2,107	11,683	77	17,557	113,533	127	48,007	320,393	177	93,457	632,233
28	2,269	13,952	78	18,019	131,552	128	48,769	369,152	178	94,519	726,752
29	2,437	16,389	79	18,487	150,039	129	49,537	418,689	179	95,587	822,339
30	2,611	19,000	80	18,961	169,000	130	50,311	469,000	180	96,661	919,000
31	2,791	2,791	81	19,441	19,441	131	51,091	51,091	181	97,741	97,741
32	2,977	5,768	82	19,927	39,568	132	51,877	102,968	182	98,827	196,568
33	3,169	8,937	83	20,419	59,787	133	52,669	155,637	183	99,919	296,487
34	3,367	12,304	84	20,917	80,704	134	53,467	209,104	184	101,017	397,504
35	3,571	15,875	85	21,421	102,125	135	54,271	263,375	185	102,121	499,625
36	3,781	19,656	86	21,931	124,056	136	55,081	318,456	186	103,231	602,856
37	3,997	23,653	87	22,447	146,503	137	55,897	374,353	187	104,347	707,203
38	4,219	27,872	88	22,969	169,472	138	56,719	431,072	188	105,469	812,672
39	4,447	32,319	89	23,497	192,969	139	57,547	488,619	189	106,597	919,269
40	4,681	37,000	90	24,031	217,000	140	58,381	547,000	190	107,731	1,027,000
41	4,921	4,921	91	24,571	24,571	141	59,221	59,221	191	108,871	1,08,871
42	5,167	10,088	92	25,117	49,688	142	60,067	119,288	192	110,017	218,888
43	5,419	15,507	93	25,669	75,357	143	60,919	180,207	193	111,169	330,057
44	5,677	21,184	94	26,227	101,584	144	61,777	241,984	194	112,327	442,384
45	5,941	27,125	95	26,791	129,375	145	62,641	304,625	195	113,491	555,875
46	6,211	33,336	96	27,361	155,736	146	63,511	368,136	196	114,661	670,536
47	6,487	39,823	97	27,937	183,673	147	64,387	432,523	197	115,837	786,373
48	6,769	46,592	98	28,519	212,192	148	65,269	497,792	198	117,019	903,392
49	7,057	53,649	99	29,107	241,299	149	66,157	563,949	199	118,207	1,021,599
50	7,351	61,000	100	29,701	271,000	150	67,051	631,000	200	119,401	1,141,000

## CUBE ROOT TABLES

No.	Divisor	Accumulation	No.	Divisor	Accumulation	No.	Divisor	Accumulation	No.	Divisor	Accumulation
201	120,601	120,601	251	188,251	188,251	301	270,901	270,901	351	368,551	368,551
202	121,807	242,408	252	189,757	378,008	302	272,707	543,608	352	370,657	739,208
203	123,019	365,427	253	191,269	569,277	303	274,519	818,127	353	372,769	1,111,977
204	124,237	489,664	254	192,787	762,064	304	276,337	1,094,464	354	374,887	1,486,864
205	125,461	615,125	255	194,311	956,375	305	278,161	1,372,625	355	377,011	1,863,875
206	126,691	741,816	256	195,841	1,152,216	306	279,991	1,652,616	356	379,141	2,243,016
207	127,927	869,743	257	197,377	1,349,593	307	281,827	1,934,443	357	381,277	2,624,293
208	129,169	998,912	258	198,919	1,548,512	308	283,669	2,218,112	358	383,419	3,007,712
209	130,417	1,129,329	259	200,467	1,748,979	309	285,517	2,503,629	359	385,567	3,393,279
210	131,671	1,261,000	260	202,021	1,951,000	310	287,371	2,791,000	360	387,721	3,781,000
211	132,931	132,931	261	203,581	203,581	311	289,231	289,231	361	389,881	389,881
212	134,197	267,128	262	205,147	408,728	312	291,097	580,328	362	392,047	781,928
213	135,469	402,597	263	206,719	615,447	313	292,969	873,297	363	394,219	1,176,147
214	136,747	539,344	264	208,297	823,744	314	294,847	1,168,144	364	396,397	1,572,544
215	138,031	677,375	265	209,881	1,033,625	315	296,731	1,464,875	365	398,581	1,971,125
216	139,321	816,696	266	211,471	1,245,096	316	298,621	1,763,496	366	400,771	2,371,896
217	140,617	957,513	267	213,067	1,458,163	317	300,517	2,064,013	367	402,967	2,774,863
218	141,919	1,099,232	268	214,669	1,672,832	318	302,419	2,366,432	368	405,169	3,180,032
219	143,227	1,242,459	269	216,277	1,889,109	319	304,327	2,670,759	369	407,377	3,587,409
220	144,541	1,387,000	270	217,891	2,107,000	320	306,241	2,977,000	370	409,591	3,997,000
221	145,861	145,861	271	219,511	219,511	321	308,161	308,161	371	411,811	411,811
222	147,187	293,048	272	221,137	440,648	322	310,087	618,248	372	414,037	825,848
223	148,519	441,587	273	222,769	663,417	323	312,019	930,267	373	416,269	1,242,117
224	149,857	591,424	274	224,407	887,824	324	313,957	1,244,224	374	418,507	1,660,624
225	151,201	742,625	275	226,051	1,113,875	325	315,901	1,560,125	375	420,751	2,081,375
226	152,551	895,176	276	227,701	1,341,576	326	317,851	1,877,976	376	423,001	2,504,376
227	153,907	1,049,083	277	229,357	1,570,933	327	319,807	2,197,783	377	425,257	2,929,633
228	155,269	1,204,352	278	231,019	1,801,952	328	321,769	2,519,552	378	427,519	3,357,152
229	156,637	1,360,989	279	232,687	2,034,639	329	323,737	2,843,289	379	429,787	3,786,939
230	158,011	1,519,000	280	234,361	2,269,000	330	325,711	3,169,000	380	432,061	4,219,000
231	159,391	159,391	281	236,041	236,041	331	327,691	327,691	381	434,341	434,341
232	160,777	320,168	282	237,727	473,768	332	329,677	657,368	382	436,627	870,968
233	162,169	482,337	283	239,419	713,187	333	331,669	989,037	383	438,919	1,309,887
234	163,567	645,904	284	241,117	954,504	334	333,667	1,322,704	384	441,217	1,751,104
235	164,971	810,875	285	242,821	1,197,125	335	335,671	1,658,375	385	443,521	2,194,625
236	166,381	977,256	286	244,531	1,441,656	336	337,681	1,996,056	386	445,831	2,640,456
237	167,797	1,145,053	287	246,247	1,687,903	337	339,697	2,335,753	387	448,147	3,088,603
238	169,219	1,314,272	288	247,969	1,935,872	338	341,719	2,677,472	388	450,469	3,539,072
239	170,647	1,484,919	289	249,697	2,185,569	339	343,747	3,021,219	389	452,797	3,991,869
240	172,081	1,657,000	290	251,431	2,437,000	340	345,781	3,367,000	390	455,131	4,447,000
241	173,521	173,521	291	253,171	253,171	341	347,821	347,821	391	457,471	457,471
242	174,967	348,488	292	254,917	508,088	342	349,867	697,688	392	459,817	917,288
243	176,419	524,907	293	256,669	764,757	343	351,919	1,049,607	393	462,169	1,379,457
244	177,877	702,784	294	258,427	1,023,184	344	353,977	1,403,584	394	464,527	1,843,684
245	179,341	882,125	295	260,191	1,283,375	345	356,041	1,759,625	395	466,891	2,310,875
246	180,811	1,062,936	296	261,961	1,545,336	346	358,111	2,117,736	396	469,261	2,780,136
247	182,287	1,245,223	297	263,737	1,809,073	347	360,187	2,477,923	397	471,637	3,251,773
248	183,769	1,428,992	298	265,519	2,074,592	348	362,269	2,840,192	398	474,019	3,725,792
249	185,257	1,614,249	299	267,307	2,341,899	349	364,357	3,204,549	399	476,407	4,202,199
250	186,751	1,801,000	300	269,101	2,611,000	350	366,451	3,571,000	400	478,801	4,681,000

## CUBE ROOT TABLES

No.	Divisor	Accumulation	No.	Divisor	Accumulation	No.	Divisor	Accumulation	No.	Divisor	Accumulation
401	481,201	481,201	451	608,851	608,851	501	751,501	751,501	551	909,151	909,151
402	483,607	964,808	452	611,557	1,220,408	502	754,507	1,506,008	552	912,457	1,821,608
403	486,019	1,450,827	453	614,269	1,834,677	503	757,519	2,263,527	553	915,769	2,737,377
404	488,437	1,939,264	454	616,987	2,451,864	504	760,537	3,024,064	554	919,087	3,656,464
405	490,861	2,430,125	455	619,711	3,071,375	505	763,561	3,787,625	555	922,411	4,578,875
406	493,291	2,923,416	456	622,441	3,693,816	506	766,591	4,564,216	556	925,741	5,504,616
407	495,727	3,419,143	457	625,177	4,318,993	507	769,627	5,323,843	557	929,077	6,433,693
408	498,169	3,917,312	458	627,919	4,946,912	508	772,669	6,096,512	558	932,419	7,366,112
409	500,617	4,417,929	459	630,667	5,577,579	509	775,717	6,872,229	559	935,767	8,301,879
410	503,071	4,921,000	460	633,421	6,211,000	510	778,771	7,651,000	560	939,121	9,241,000
411	505,531	505,531	461	636,181	636,181	511	781,831	781,831	561	942,481	942,481
412	507,997	1,013,528	462	638,947	1,275,128	512	784,897	1,566,728	562	945,847	1,888,328
413	510,469	1,523,997	463	641,719	1,916,847	513	787,969	2,354,697	563	949,219	2,837,547
414	512,947	2,036,944	464	644,497	2,561,344	514	791,047	3,145,744	564	952,597	3,790,144
415	515,431	2,552,375	465	647,281	3,208,625	515	794,131	3,939,875	565	955,981	4,746,125
416	517,921	3,070,296	466	650,071	3,858,696	516	797,221	4,737,096	566	959,371	5,705,486
417	520,417	3,590,713	467	652,867	4,511,563	517	800,317	5,537,413	567	962,767	6,668,263
418	522,919	4,113,632	468	655,669	5,167,232	518	803,419	6,340,832	568	966,169	7,634,432
419	525,427	4,639,059	469	658,477	5,825,709	519	806,527	7,147,359	569	969,577	8,604,009
420	527,941	5,167,000	470	661,291	6,487,000	520	809,641	7,957,000	570	972,991	9,577,000
421	530,461	530,461	471	664,111	664,111	521	812,761	812,761	571	976,411	976,411
422	532,987	1,063,937	472	666,937	1,331,048	522	815,887	1,628,648	572	979,837	1,956,248
423	535,519	1,598,967	473	669,769	2,000,817	523	819,019	2,447,667	573	983,269	2,939,517
424	538,057	2,137,024	474	672,607	2,673,424	524	822,157	3,269,824	574	986,707	3,926,224
425	540,601	2,677,625	475	675,451	3,346,875	525	825,301	4,095,125	575	990,151	4,916,575
426	543,151	3,220,776	476	678,301	4,027,176	526	828,451	4,923,576	576	993,601	5,909,976
427	545,707	3,766,483	477	681,157	4,708,333	527	831,607	5,755,183	577	997,057	6,907,033
428	548,269	4,314,752	478	684,019	5,392,352	528	834,769	6,589,952	578	1,000,519	7,907,552
429	550,837	4,865,589	479	686,887	6,079,239	529	837,937	7,427,889	579	1,003,987	8,911,539
430	553,411	5,419,000	480	689,761	6,769,000	530	841,111	8,269,000	580	1,007,461	9,919,000
431	555,991	555,991	481	692,641	692,641	531	844,291	844,291	581	1,010,941	1,010,941
432	558,577	1,114,568	482	695,527	1,388,168	532	847,477	1,691,768	582	1,014,427	2,025,368
433	561,169	1,675,737	483	698,419	2,086,587	533	850,669	2,542,437	583	1,017,919	3,043,287
434	563,767	2,239,504	484	701,317	2,787,904	534	853,867	3,396,304	584	1,021,417	4,064,704
435	566,371	2,805,875	485	704,221	3,492,125	535	857,071	4,253,375	585	1,024,921	5,086,625
436	568,981	3,374,856	486	707,131	4,199,256	536	860,281	5,113,656	586	1,028,431	6,118,056
437	571,597	3,946,453	487	710,047	4,909,303	537	863,497	5,977,153	587	1,031,947	7,150,003
438	574,219	4,520,672	488	712,969	5,622,272	538	866,719	6,843,872	588	1,035,469	8,185,472
439	576,847	5,097,519	489	715,897	6,338,169	539	869,947	7,713,819	589	1,038,997	9,224,469
440	579,481	5,677,000	490	718,831	7,057,000	540	873,181	8,587,000	590	1,042,531	10,267,000
441	582,121	582,121	491	721,771	721,771	541	876,421	876,421	591	1,046,071	1,046,071
442	584,767	1,166,888	492	724,717	1,446,488	542	879,667	1,756,088	592	1,049,617	2,093,688
443	587,419	1,754,307	493	727,669	2,174,157	543	882,919	2,639,007	593	1,053,169	3,148,857
444	590,077	2,344,384	494	730,627	2,904,784	544	886,177	3,525,184	594	1,056,727	4,205,584
445	592,741	2,937,125	495	733,591	3,638,375	545	889,441	4,414,625	595	1,060,291	5,265,875
446	595,411	3,532,536	496	736,561	4,374,936	546	892,711	5,307,336	596	1,063,861	6,329,736
447	598,087	4,130,623	497	739,537	5,114,473	547	895,987	6,203,823	597	1,067,437	7,397,173
448	600,769	4,731,392	498	742,519	5,856,992	548	899,289	7,102,592	598	1,071,019	8,468,192
449	603,457	5,334,849	499	745,507	6,602,499	549	902,557	8,005,149	599	1,074,607	9,542,799
450	606,151	5,941,000	500	748,501	7,351,000	550	905,851	8,911,000	600	1,078,201	10,621,000

## CUBE ROOT TABLES

No.	Divisor	Accumulation	No.	Divisor	Accumulation	No.	Divisor	Accumulation	No.	Divisor	Accumulation
601	1,081,801	1,081,801	651	1,269,451	1,269,451	701	1,472,101	1,472,101	751	1,689,751	1,689,751
602	1,085,407	2,167,208	652	1,273,357	2,542,808	702	1,476,307	2,946,408	752	1,694,257	3,384,008
603	1,089,019	3,256,227	653	1,277,269	3,820,077	703	1,480,519	4,428,927	753	1,698,769	5,082,777
604	1,092,637	4,348,864	654	1,281,187	5,101,264	704	1,484,737	5,918,664	754	1,703,287	6,786,064
605	1,096,261	5,445,125	655	1,285,111	6,386,375	705	1,488,961	7,402,625	755	1,707,811	8,493,875
606	1,099,891	6,545,016	656	1,289,041	7,675,416	706	1,493,191	8,895,816	756	1,712,341	10,206,216
607	1,103,527	7,648,543	657	1,292,977	8,968,393	707	1,497,427	10,393,243	757	1,716,877	11,923,093
608	1,107,169	8,755,712	658	1,296,919	10,265,312	708	1,501,669	11,894,912	758	1,721,419	13,644,512
609	1,110,817	9,866,529	659	1,300,867	11,566,179	709	1,505,917	13,400,829	759	1,725,967	15,370,479
610	1,114,471	10,981,000	660	1,304,821	12,871,000	710	1,510,171	14,911,000	760	1,730,521	17,101,000
611	1,118,131	1,118,131	661	1,308,781	1,308,781	711	1,514,431	1,514,431	761	1,735,081	1,735,081
612	1,121,797	2,239,928	662	1,312,747	2,621,528	712	1,518,697	3,033,128	762	1,739,647	3,474,728
613	1,125,469	3,369,397	663	1,316,719	3,938,247	713	1,522,969	4,556,097	763	1,744,219	5,218,947
614	1,129,147	4,494,544	664	1,320,697	5,258,944	714	1,527,247	6,085,544	764	1,748,797	6,967,744
615	1,132,831	5,627,375	665	1,324,681	6,583,625	715	1,531,531	7,614,875	765	1,753,381	8,721,125
616	1,136,521	6,763,896	666	1,328,671	7,912,296	716	1,535,821	9,150,696	766	1,757,971	10,479,096
617	1,140,217	7,904,113	667	1,332,667	9,244,963	717	1,540,117	10,690,813	767	1,762,567	12,241,663
618	1,143,919	9,048,032	668	1,336,669	10,581,632	718	1,544,419	12,235,232	768	1,767,169	14,008,832
619	1,147,627	10,195,659	669	1,340,677	11,922,309	719	1,548,727	13,783,959	769	1,771,777	15,780,609
620	1,151,341	11,347,000	670	1,344,691	13,267,000	720	1,553,041	15,337,000	770	1,776,391	17,557,000
621	1,155,061	1,155,061	671	1,348,711	1,348,711	721	1,557,361	1,557,361	771	1,781,011	1,781,011
622	1,158,787	2,313,848	672	1,352,737	2,701,448	722	1,561,687	3,119,048	772	1,785,637	3,566,648
623	1,162,519	3,476,367	673	1,356,769	4,058,217	723	1,566,019	4,685,067	773	1,790,269	5,356,917
624	1,166,257	4,642,624	674	1,360,807	5,419,024	724	1,570,357	6,255,424	774	1,794,907	7,151,824
625	1,170,001	5,812,625	675	1,364,851	6,783,875	725	1,574,701	7,830,125	775	1,799,551	8,951,375
626	1,173,751	6,986,376	676	1,368,901	8,152,776	726	1,579,051	9,409,176	776	1,804,201	10,755,576
627	1,177,507	8,163,883	677	1,372,957	9,525,733	727	1,583,407	10,992,583	777	1,808,857	12,564,433
628	1,181,269	9,345,152	678	1,377,019	10,902,752	728	1,587,769	12,590,352	778	1,813,519	14,377,952
629	1,185,037	10,530,169	679	1,381,087	12,285,839	729	1,592,137	14,172,489	779	1,818,187	16,196,139
630	1,188,811	11,719,000	680	1,385,161	13,669,000	730	1,596,511	15,769,000	780	1,822,861	18,019,000
631	1,192,591	1,192,591	681	1,389,241	1,389,241	731	1,600,891	1,600,891	781	1,827,541	1,827,541
632	1,196,377	2,388,968	682	1,393,327	2,782,568	732	1,605,277	3,206,168	782	1,832,227	3,659,768
633	1,200,169	3,589,137	683	1,397,419	4,179,987	733	1,609,669	4,815,837	783	1,836,919	5,496,687
634	1,203,967	4,793,164	684	1,401,517	5,581,504	734	1,614,067	6,429,904	784	1,841,617	7,338,304
635	1,207,771	6,000,875	685	1,405,621	6,987,125	735	1,618,471	8,048,375	785	1,846,321	9,184,625
636	1,211,581	7,212,456	686	1,409,731	8,396,856	736	1,622,881	9,671,256	786	1,851,031	11,035,656
637	1,215,397	8,427,853	687	1,413,847	9,810,703	737	1,627,297	11,298,553	787	1,855,747	12,891,403
638	1,219,219	9,647,072	688	1,417,969	11,228,672	738	1,631,719	12,930,272	788	1,860,469	14,751,872
639	1,223,047	10,870,119	689	1,422,097	12,650,769	739	1,636,147	14,566,419	789	1,865,197	16,617,069
640	1,226,881	12,097,000	690	1,426,231	14,077,000	740	1,640,581	16,207,000	790	1,869,951	18,487,000
641	1,230,721	1,230,721	691	1,430,371	1,430,371	741	1,645,021	1,645,021	791	1,874,671	1,874,671
642	1,234,567	2,465,288	692	1,434,517	2,864,888	742	1,649,467	3,294,488	792	1,879,417	3,794,408
643	1,238,419	3,703,707	693	1,438,669	4,303,557	743	1,653,919	4,948,407	793	1,884,169	5,638,257
644	1,242,277	4,945,984	694	1,442,827	5,746,384	744	1,658,377	6,606,784	794	1,888,927	7,527,184
645	1,246,141	6,192,125	695	1,446,991	7,193,375	745	1,662,841	8,269,625	795	1,893,691	9,420,875
646	1,250,011	7,442,136	696	1,451,161	8,644,536	746	1,667,311	9,936,936	796	1,898,461	11,319,336
647	1,253,897	8,696,023	697	1,455,337	10,099,873	747	1,671,787	11,608,723	797	1,903,237	13,222,573
648	1,257,769	9,953,792	698	1,459,519	11,559,392	748	1,676,269	13,284,992	798	1,908,019	15,130,592
649	1,261,657	11,215,449	699	1,463,707	13,023,099	749	1,680,757	14,965,749	799	1,912,807	17,043,399
650	1,265,551	12,481,000	700	1,467,901	14,491,000	750	1,685,251	16,651,000	800	1,917,601	18,961,000



## CUBE ROOT TABLES

No.	Divisor	Accumulation	No.	Divisor	Accumulation	No.	Divisor	Accumulation	No.	Divisor	Accumulation
801	1,922,401	1,922,401	851	2,170,051	2,170,051	901	2,432,701	2,432,701	951	2,710,551	2,710,551
802	1,927,207	3,849,608	852	2,175,157	4,345,208	902	2,435,107	4,870,808	952	2,716,057	5,426,408
803	1,932,019	5,781,627	853	2,180,269	6,525,477	903	2,443,519	7,314,327	953	2,721,769	8,148,177
804	1,936,837	7,718,464	854	2,185,387	8,710,864	904	2,448,937	9,763,264	954	2,727,487	10,875,664
805	1,941,661	9,660,125	855	2,190,511	10,901,375	905	2,454,361	12,217,625	955	2,733,211	13,608,875
806	1,946,491	11,606,616	856	2,195,641	13,097,016	906	2,459,791	14,677,416	956	2,738,941	16,347,816
807	1,951,327	13,557,943	857	2,200,777	15,297,793	907	2,465,227	17,142,643	957	2,744,677	19,092,493
808	1,956,169	15,514,112	858	2,205,919	17,508,712	908	2,470,669	19,613,312	958	2,750,419	21,842,912
809	1,961,017	17,475,139	859	2,211,067	19,716,779	909	2,476,117	22,089,429	959	2,756,167	24,599,079
810	1,965,871	19,441,000	860	2,216,221	21,931,000	910	2,481,571	24,571,000	960	2,761,921	27,361,000
811	1,970,731	1,970,731	861	2,221,381	2,221,381	911	2,487,031	2,487,031	961	2,767,681	2,767,681
812	1,975,597	3,946,328	862	2,226,547	4,447,928	912	2,492,497	4,979,528	962	2,773,447	5,541,128
813	1,980,469	5,926,797	863	2,231,719	6,679,647	913	2,497,969	7,477,407	963	2,779,219	8,320,347
814	1,985,347	7,912,144	864	2,236,897	8,916,544	914	2,503,447	9,980,944	964	2,784,997	11,105,344
815	1,990,231	9,902,375	865	2,242,081	11,158,625	915	2,508,931	12,489,875	965	2,790,781	13,896,125
816	1,995,121	11,897,496	866	2,247,271	13,405,896	916	2,514,421	15,004,296	966	2,796,571	16,692,696
817	2,000,017	13,897,513	867	2,252,467	15,658,363	917	2,519,917	17,524,213	967	2,802,367	19,495,063
818	2,004,919	15,902,432	868	2,257,669	17,916,032	918	2,525,419	20,049,632	968	2,808,169	22,303,232
819	2,009,827	17,912,259	869	2,262,877	20,178,909	919	2,530,927	22,580,359	969	2,813,977	25,117,209
820	2,014,741	19,927,000	870	2,268,091	22,447,000	920	2,536,441	25,117,000	970	2,819,791	27,937,000
821	2,019,661	2,019,661	871	2,273,311	2,273,311	921	2,541,961	2,541,961	971	2,825,611	2,825,611
822	2,024,587	4,044,248	872	2,278,537	4,551,848	922	2,547,487	5,089,448	972	2,831,437	5,774,048
823	2,029,519	6,073,767	873	2,283,769	6,836,617	923	2,553,019	7,642,467	973	2,837,269	8,494,317
824	2,034,457	8,108,224	874	2,289,007	9,124,624	924	2,558,557	10,201,024	974	2,843,107	11,337,424
825	2,039,401	10,147,625	875	2,294,251	11,618,875	925	2,564,101	12,765,125	975	2,848,951	14,186,375
826	2,044,351	12,191,976	876	2,299,501	13,718,376	926	2,569,651	15,334,776	976	2,854,801	17,041,176
827	2,049,307	14,241,283	877	2,304,757	16,023,133	927	2,575,207	17,909,983	977	2,860,657	19,901,833
828	2,054,269	16,295,552	878	2,310,019	18,333,152	928	2,580,769	20,490,752	978	2,866,519	22,768,352
829	2,059,237	18,354,789	879	2,315,287	20,648,439	929	2,586,337	23,077,089	979	2,872,387	25,640,799
830	2,064,211	20,419,000	880	2,320,561	22,969,000	930	2,591,911	25,669,000	980	2,878,261	28,519,000
831	2,069,191	2,069,191	881	2,325,841	2,325,841	931	2,597,491	2,597,491	981	2,884,141	2,884,141
832	2,074,177	4,145,368	882	2,331,127	4,656,968	932	2,603,077	5,200,568	982	2,890,027	5,774,168
833	2,079,169	6,222,537	883	2,336,419	6,993,587	933	2,608,669	7,809,237	983	2,895,919	8,670,087
834	2,084,167	8,306,704	884	2,341,717	9,335,104	934	2,614,267	10,423,504	984	2,901,817	11,571,904
835	2,089,171	10,395,875	885	2,347,021	11,682,125	935	2,619,871	13,043,375	985	2,907,721	14,479,625
836	2,094,181	12,490,056	886	2,352,331	14,034,456	936	2,625,481	15,668,856	986	2,913,631	17,393,256
837	2,099,197	14,589,253	887	2,357,647	16,392,103	937	2,631,097	17,299,953	987	2,919,547	20,312,803
838	2,104,219	16,693,472	888	2,362,969	18,755,072	938	2,636,719	20,936,672	988	2,925,469	23,238,272
839	2,109,247	18,802,719	889	2,368,297	21,123,569	939	2,642,347	23,579,019	989	2,931,397	26,169,669
840	2,114,281	20,917,000	890	2,373,631	23,497,000	940	2,647,981	26,227,000	990	2,937,331	29,107,000
841	2,119,321	2,119,321	891	2,378,971	2,378,971	941	2,653,621	2,653,621	991	2,943,271	2,943,271
842	2,124,367	4,243,688	892	2,384,317	4,763,288	942	2,659,267	5,312,888	992	2,949,217	5,892,488
843	2,129,419	6,373,107	893	2,389,669	7,152,957	943	2,664,919	7,977,807	993	2,955,169	8,847,657
844	2,134,477	8,507,584	894	2,395,027	9,547,984	944	2,670,577	10,648,384	994	2,961,127	11,808,704
845	2,139,541	10,647,125	895	2,400,391	11,948,375	945	2,676,241	13,324,625	995	2,967,091	14,775,875
846	2,144,611	12,791,736	896	2,405,761	14,354,136	946	2,681,911	16,006,536	996	2,973,061	17,748,936
847	2,149,687	14,941,423	897	2,411,137	16,765,273	947	2,687,587	18,694,123	997	2,978,937	20,727,973
848	2,154,769	17,096,192	898	2,416,519	19,181,792	948	2,693,269	21,387,392	998	2,985,019	23,712,992
849	2,159,857	19,256,049	899	2,421,907	21,603,699	949	2,698,957	24,086,349	999	2,991,007	26,703,999
850	2,164,951	21,421,000	900	2,427,301	24,051,000	950	2,704,651	26,791,000	1000	2,997,001	29,701,000

## APPENDIX TO OPERATING INSTRUCTIONS

To make a key-operated, multiple-order calculating machine so that it could be run both forward (additive) and backward (subtractive), would involve mechanism so complicated, especially in its carrying mechanism, as to be not only impracticable, but absolutely absurd.

Therefore on a key-operated machine subtraction, division and other operations of a negative character are performed by touching on the keys the complements of numbers to be subtracted, the complements of divisors in division and the complements of the terms of a geometrical ratio in square root, etc., etc.

The complement of a number is that number which added to it, results in a series of ciphers directly beneath it, with 1 carried to the next column to the left, thus the complement

of	13074	of	657
is	86926	is	343
	<u>100000</u>		<u>1000</u>

It will be observed that in each of these illustrations the sum of the two figures in the first column is 10, and that the sum of the two figures in each of the other columns taken by itself is 9. This is because the 1 carried from the first column into the second, added to 9 makes 10, and the 1 carried from the second column to the third added to 9 makes 10, and so on clear across.

Thus, 6+4 is.....10  
 2+7+1 to carry is.....10  
 9+0+1 to carry is.....10  
 3+6+1 to carry is.....10  
 8+1+1 to carry is.....10

13074  
 86926  
 —  
 10  
 —  
 100  
 —  
 1000  
 —  
 10000  
 —  
 100000

We call a number which added to a digit makes 10, its complement, and a number which added to a digit makes 9, its co-digit. Thus the complement of 6 is 4, and the co-digit of 6 is 3, because 6+4=10, and 6+3=9.

We can find the difference between two numbers by adding the complement of the smaller to the larger and canceling the 1 carried to the extreme left.

**Example:** 47631—13074

Larger number.....47631  
 Complement of smaller number (13074).....86926  
 Answer.....134557

In a calculating machine the carrying is a process entirely independent of the consciousness of the operator. Hence it follows that with the larger of two numbers on the register, if the operator merely touches in each column a key which will add the co-digital value of each digit of the smaller number except the one to the extreme right, and touches the complement of the extreme right-hand digit, he will then have on the register the difference between the two numbers, providing he can prevent the carrying of the 1 from the extreme left-hand number to the next higher order, wherever that order happens to be.

It further follows that if there were placed on each *units* key, beside its normal digit, a number in smaller type indicating its complement, and if on all the other keys of the machine there were placed beside the digit a number indicating its co-digit, all the operator would have to do to subtract any number ending with a digit in the units column would be to strike the keys indicating in smaller type the number to be subtracted, providing he has, as on the Comptometer, means for preventing carrying to the left of the highest column in which any key is touched.

In practice there is not always a digit in the units column of a number to be subtracted, and frequently it is desirable to make a subtraction from a number standing several columns to the left of the units column of the machine, such as in subtracting from a quotient at the conclusion of a performance in division, or in using decimal numbers or in correcting a mistake of the operator in touching the keys. Also in performing division the divisor needs to be touched in accordance with the small figures on the keys in a position where its units figure does not correspond with the units column of the machine. For this reason it is desirable to place co-digits on all the keys and direct the operator to always touch, for the extreme right-hand digit of a number to be struck on the keys according to the small figures, a key bearing a co-digit which is one less than the right-hand digit.

Since for each subtraction there is one carried to the left of the highest key touched unless prevented by the use of the subtraction cut-offs, a series of subtractions accomplishes division.

**Example:**  $465 \div 222$ .

Keys touched:

Digits . . . . .	465
Co-digits 221, same as digits . . . . .	778
	1 243
Co-digits 221 repeated again . . . . .	778
	2 021

The quotient is 2 and the remainder is 21.

**Example:**  $1384 \div 645$ .

If we were doing subtraction proper the keys touched would be—

	Cut Off
Digits . . . . .	1384
Co-digits . . . . .	0644

But in division we may omit to strike the 0 under the 1 in the fourth column and simply strike the co-digits 644, thus:—

Keys to be struck:

Digits . . . . .	1 384
Co-digits 644, same as digits . . . . .	355
	1 739
Co-digits 644 repeated again . . . . .	355
	2 094

The quotient is 2 and the remainder 94.

In examples involving two or more places in the quotient the principle is just the same as above except that instead of beginning to subtract with the units of the divisor under the unit of the dividend, which would necessitate making a great number of subtractions, we begin subtracting from the fewest figures in the left of the dividend which will contain the divisor.

**Example:**  $2863 \div 68$ .

Keys to be struck:

Digits . . . . .	2 863
Co-digits 67 same as digits . . . . .	32
	3 183
Co-digits 67 repeated again . . . . .	32
	3 503
Co-digits 67 repeated again . . . . .	32
	*3 823
Co-digits 67 repeated again . . . . .	32
	4 143
Co-digits 67 repeated again . . . . .	32
	41 75
Co-digits 67 repeated again . . . . .	32
	42 07

The quotient is 42 and the remainder 7.

\* Here, for the first time, the number of strokes on the keys (subtractions) agree with the quotient figures, but there is a remainder of 82, so we continue to strike the keys until the remainder becomes less than the divisor 68, which it does at the next stroke, showing the first quotient figure to be 4.



## DISCOUNT

A Discount is a certain percentage to be deducted.

The "Net" of a Discount is the difference between it and 100%.

EXAMPLE:

45 pairs of Rubbers @ \$1.60

Less 35%

The "Net" of 35% is 100-35 = 65%

### METHOD 1

Multiply the quantity by the price. Clear the machine. Multiply the gross extension by the discount and subtract from the gross, e. g.

$$\begin{array}{r} 45 \times \$1.60 = \$72.00 \\ \$72.00 \times .35 = 25.20 \\ \hline \end{array}$$

$$72.00 - \$25.20 = \$46.80$$

Multiplying the gross by the actual discount, as above, gives the amount of the discount, which must then be deducted from the gross.

Firms accustomed to using this method in mental work may claim it necessary to show the deduction, to aid the customer in checking the invoice. This does not, however, relieve the customer of any figuring. His calculations are the same whether the "Net" only or both the Discount and the "Net" are shown. Employing Method No. 2 or No. 3 increases the efficiency on the original work.

### METHOD 2

$$45 \times \$1.60 = \$72.00$$

Clear the machine.

$$72.00 \times .65 = \$46.80$$

(Net of discount)

Multiplying the Gross by the Net of the Discount gives the proceeds direct.

### METHOD 3

$$45 \times \$1.60 = \$72.00$$

Leave this in the machine and multiply by the Net of the Discount, (65), i. e., using the keys 64, commencing at the left and multiplying toward the right, (see "Three Factor Work,") which gives us the result, \$46.80.

EXAMPLE 2:

15 doz. pairs Suspenders @ \$ 5.80

Less 7%

The "Net" of 7%, 100-7 = 93%

$$15 \times \$5.80 = 87.00$$

$$\$87.00 \times .93 \text{ (Net of discount)} = 80.91$$

EXAMPLE 3:

8 doz. Shirts — \$13.50 = \$108.00

Less 7½%

The "Net" of 7½%, 100-7½ = .925

$$108 \times .925 \text{ (Net of discount)} = 99.90$$

### CHAIN DISCOUNT

The "Net" of a chain of discounts is the result obtained by multiplying together the "Net" of each of the several discounts in the chain.

#### EXAMPLE:

Find the "Net" of 25-15-6%.

The "Net" of each of the single discounts is 75-85-94% respectively.

#### METHOD

Add in the machine on the right the net of the first discount, 75. Multiply this by the net of the next discount, 85, using the keys 84. (See "Three Factor Work.")

$$.75 \times .85 = .6375$$

Leaving this result in the machine, multiply by the net of the following discount, .94, in the same manner —

$$.6375 \times .94 = .59925, \text{ The Net Discount of chain.}$$

#### EXAMPLE 2:

Find the net of

$$62\frac{1}{2}\text{--}10\text{--}10\text{--}5\text{--}2\frac{1}{2}\%$$

The Net of each  
single discount is  $37.5\text{--}90\text{--}90\text{--}95\text{--}97.5\%$

Add in the machine on the right the Net of the first discount, .375; multiply by the net of the next discount, .90, (using keys 89), continuing in the same manner with each succeeding result and discount. The final Net of these discounts is .281348+

Add the net of the first discount—.375—in the machine.

$$.375 \times .90 = .3375$$

(using keys 89)

$$.3375 \times .90 = .30375$$

(using keys 89)

$$.30375 \times .95 = .28856$$

(using keys 94)

$$.28856 \times .975 = .281346$$

(using keys 974)

#### POINTING OFF

Point off as many places as there are decimals in all the factors used.

The following Discount Table gives the "Nets" of various chain discounts and will be useful in many cases. It will be found to cover most of the chain discounts in ordinary business use. Other combinations that are used frequently can be worked out and the net discounts noted.

With the 12-column Comptometer, the above will be figured complete without clearing. With the smaller Comptometer, it must be cleared once.

### TABLE SHOWING THE "NET" OF VARIOUS CHAIN DISCOUNTS

Rate %	20	25	30	33½	35	40	45	50
2½	.78	.73125	.6825	.65	.63375	.585	.53625	.4875
5	.76	.7125	.665	.63333	.6175	.57	.5225	.475
5 2½	.741	.69469	.64838	.6175	.60206	.55575	.50944	.46313
5 5	.722	.67688	.63175	.60167	.58663	.5415	.49638	.45125
5 5 2½	.70395	.65995	.61596	.58663	.57196	.52796	.48397	.43999
7½	.74	.69375	.6475	.61667	.60125	.555	.50875	.4625
7½ 2½	.7215	.67641	.63131	.60125	.58622	.54113	.49603	.45094
7½ 5	.703	.65906	.61513	.58583	.57119	.52725	.48331	.43938
10	.72	.675	.63	.6	.585	.54	.495	.45
10 2½	.702	.65813	.61425	.585	.57038	.5265	.48263	.43875
10 5	.684	.64125	.5985	.57	.55575	.513	.47025	.4275
10 5 2½	.6669	.62522	.58354	.55575	.54186	.50018	.45849	.41681
10 7½	.666	.62438	.58275	.555	.54113	.4995	.45788	.41625
10 10	.648	.6075	.567	.54	.5265	.486	.4455	.405
10 10 5	.6156	.57713	.53865	.513	.50018	.4617	.42323	.38475
10 10 5 2½	.60021	.5627	.52518	.50018	.48767	.45016	.41264	.37513
Rate %	55	60	65	66½	70	75	80	85
2½	.43875	.39	.34125	.325	.2925	.24375	.195	.14625
5	.4275	.38	.3325	.31667	.285	.2375	.19	.1425
5 2½	.41681	.3705	.32419	.30875	.27788	.23156	.18525	.13894
5 5	.40613	.361	.31588	.30083	.27075	.22563	.1805	.13538
5 5 2½	.39597	.35198	.30798	.29331	.26398	.21998	.17599	.13199
7½	.41625	.37	.32375	.30833	.2775	.23125	.185	.13875
7½ 2½	.40584	.36075	.31566	.30063	.27056	.22547	.18038	.13528
7½ 5	.39544	.3515	.30756	.29292	.26363	.21969	.17575	.13181
10	.405	.36	.315	.3	.27	.225	.18	.135
10 2½	.39488	.351	.30713	.2925	.26325	.21938	.1755	.13163
10 5	.38475	.342	.29925	.285	.2565	.21375	.171	.12825
10 5 2½	.37513	.33345	.29177	.27788	.25009	.20841	.16673	.12504
10 7½	.37463	.333	.29138	.2775	.24975	.20813	.1665	.12488
10 10	.3645	.324	.2835	.27	.243	.2025	.162	.1215
10 10 5	.34628	.3078	.26933	.2565	.23085	.19238	.1539	.11543
10 10 5 2½	.33762	.3001	.26259	.25009	.22508	.18787	.15005	.11254

[illegible]

### EXTENDING INVOICES WITH CHAIN DISCOUNTS

To obtain the "Net" of an invoice, multiply the gross extension by the "Net" of the chain of discounts.

EXAMPLE:

156 gross Wood Screws @ \$.85

Less 85-5-5-2½% \$17.50

#### METHOD

$$156 \times .85 = \$132.60$$

The "Net" of the discounts as above is .132

$$132.60 \times .132 = 17.50$$

EXAMPLE No. 2:

8 boxes Glass @ \$18.50

Less 90-25-10% \$9.99

#### METHOD

Make the gross extension, which is \$148.00.

The "Net" of 90 being 10%, merely point off one place, giving result of \$14.80.

Multiply this by the "Net" of the balance of the chain discount, .675 and the result, \$9.99, will be obtained.

$$8 \times \$18.50 = \$148.00$$

$$\text{Point off one place to L.} = 14.80$$

$$14.80 \times .675 = \cancel{9.90} \\ 9.99$$

### TO FIND NET OF DISCOUNT CONTAINING THIRDS

EXAMPLE:

7½ doz. Globes @ \$17.00

Less 33⅓-10-5% \$72.68

#### METHOD

When a discount contains thirds, use that factor last, which enables carrying out the decimal as far as required. Thus, the Nets of the above single discounts are 66⅔-90-95%.

$$95 \times 90 = .855$$

Now, hold the result, 855, for the Multiplier, multiplying toward the left by .66667—

The 855 being in the machine once, make one less stroke in the first position.

Or,

Clear the machine and multiply

$$.855 \times .66667 = 57\%$$

$$\text{Multiply } 127.50 \times .57 = \$72.68$$



## NEGATIVE PERCENTAGE

Negative Percentage is the opposite or complement of the percentage wanted, i. e., the percent the cost represents of the **Selling Price**, is the **negative** of the percent of profit.

The great majority of commercial houses figure the percent of profit on the Selling Price.

This method of figuring percentages of Profit and Loss and Increases and Decreases, renders unnecessary the determining of the actual profit or increase or decrease in dollars and cents.

### EXAMPLE:

A coat costing \$18.00 sells for \$24.00.

What is the percent of profit?

Divide \$18.00 by 24.00 = 75, the **Cost Percent**.

The difference between 75 and 100% is the percent of Profit, 25%.

### METHOD

Add \$18.00 in the Comptometer at the left and divide by 24.00 = 75%, a negative percent.

### Convert to Actual Percent Profit

Hold back the cutoff, just at the left of 75 and add its negative, small 74, twice directly over itself, = 25%, the percent of profit.

The Increase or Decrease percent in revenue or production is based on the "Last Month" or "Last Year's" revenue.

The percent of "current" to "prior" month or year's Production or Revenue, **if a decrease, is the negative of the percent of decrease.**

### EXAMPLE:

Last Month's Production, 245 Tons.

Current Month's Production, 232 Tons.

Divide 232 by 245 = 94.7%, the percent of current Month's production to that of last Month.

The difference between it and 100% = 5.3% of Decrease.

### METHOD

Add current month, 232, in the Comptometer at the left and divide by Last Month, 245 = 94.7%. This is the negative or complement of the actual percent of decrease.

To register the percent of Decrease, simply hold back the Cutoff at the left of 947 and add the negative of 947, small —46 twice directly over itself.

## INTEREST WORK

There are several ways of figuring Interest. The method to adopt should depend on the nature of the Interest work.

The simplest Interest rule is:

$$\frac{\text{Principal} \times \text{days} \times \text{rate}}{360 \text{ (or 365)}} = \text{Interest}$$

EXAMPLE:

Interest on \$460.00 for 7 months and 17 days at 6%.

$$\frac{460. \times (7 \times 30 + 17 = 227) \times 6}{360} = \$17.40$$

This may be shortened by dividing the rate of interest by 360 for a constant factor.

The rule then becomes:

$$\frac{\text{Principal} \times \text{days} \times \text{rate}}{360} = \text{Interest}$$

Or,  $\text{Principal} \times \text{days} \times \text{rate per day} = \text{Interest}$ .

EXAMPLE:

Interest on \$460.00 for 7 months and 17 days at 6%.

$$.06 \text{ divided by } 360 = .00016667, \text{ Interest for 1 day;} \\ 460 \times 227 \times .00016667 = \$17.40$$

### INTEREST ON \$1.00 FOR 1 DAY AT 1% TO 12½%, INCLUSIVE (360 DAY YEAR)

		1/8%	1/4%	3/8%	1/2%	5/8%	3/4%	7/8%	
		.00000347 <sup>222</sup>	.00000694 <sup>444</sup>	.00001041 <sup>666</sup>	.00001388 <sup>888</sup>	.00001736 <sup>111</sup>	.00002083 <sup>333</sup>	.00002430 <sup>555</sup>	
1%	.00002777 <sup>777</sup>	.00003125	.00003472 <sup>222</sup>	.00003819 <sup>444</sup>	.00004166 <sup>666</sup>	.00004513 <sup>888</sup>	.00004861 <sup>111</sup>	.00005208 <sup>333</sup>	1%
2%	.00005555 <sup>555</sup>	.00005902 <sup>777</sup>	.0000625	.00006597 <sup>222</sup>	.00006944 <sup>444</sup>	.00007291 <sup>666</sup>	.00007638 <sup>888</sup>	.00007986 <sup>111</sup>	2%
3%	.00008333 <sup>333</sup>	.00008680 <sup>555</sup>	.00009027 <sup>777</sup>	.00009375	.00009722 <sup>222</sup>	.00010069 <sup>444</sup>	.00010416 <sup>666</sup>	.00010763 <sup>888</sup>	3%
4%	.00011111 <sup>111</sup>	.00011458 <sup>333</sup>	.00011805 <sup>555</sup>	.00012152 <sup>777</sup>	.000125	.00012847 <sup>222</sup>	.00013194 <sup>444</sup>	.00013541 <sup>666</sup>	4%
5%	.00013888 <sup>888</sup>	.00014236 <sup>111</sup>	.00014583 <sup>333</sup>	.00014930 <sup>555</sup>	.00015277 <sup>777</sup>	.00015625	.00015972 <sup>222</sup>	.00016319 <sup>444</sup>	5%
6%	.00016666 <sup>666</sup>	.00017013 <sup>888</sup>	.00017361 <sup>111</sup>	.00017708 <sup>333</sup>	.00018055 <sup>555</sup>	.00018402 <sup>777</sup>	.0001875	.00019097 <sup>222</sup>	6%
7%	.00019444 <sup>444</sup>	.00019791 <sup>666</sup>	.00020138 <sup>888</sup>	.00020486 <sup>111</sup>	.00020833 <sup>333</sup>	.00021180 <sup>555</sup>	.00021527 <sup>777</sup>	.00021875	7%
8%	.00022222 <sup>222</sup>	.00022569 <sup>444</sup>	.00022916 <sup>666</sup>	.00023263 <sup>888</sup>	.00023611 <sup>111</sup>	.00023958 <sup>333</sup>	.00024305 <sup>555</sup>	.00024652 <sup>777</sup>	8%
9%	.00025	.00025347 <sup>222</sup>	.00025694 <sup>444</sup>	.00026041 <sup>666</sup>	.00026388 <sup>888</sup>	.00026736 <sup>111</sup>	.00027083 <sup>333</sup>	.00027430 <sup>555</sup>	9%
10%	.00027777 <sup>777</sup>	.00028125	.00028472 <sup>222</sup>	.00028819 <sup>444</sup>	.00029166 <sup>666</sup>	.00029513 <sup>888</sup>	.00029861 <sup>111</sup>	.00030208 <sup>333</sup>	10%
11%	.00030555 <sup>555</sup>	.00030902 <sup>777</sup>	.0003125	.00031597 <sup>222</sup>	.00031944 <sup>444</sup>	.00032291 <sup>666</sup>	.00032638 <sup>888</sup>	.00032986 <sup>111</sup>	11%
12%	.00033333 <sup>333</sup>	.00033680 <sup>555</sup>	.00034027 <sup>777</sup>	.00034375	.00034722 <sup>222</sup>	.00035069 <sup>444</sup>	.00035416 <sup>666</sup>	.00035763 <sup>888</sup>	12%

## INTEREST AT 6% FOR VARYING PERIODS. TO OBTAIN INTEREST AT 6% FOR TWO MONTHS OR 60 DAYS

**EXAMPLES:**

**Interest on \$34,600.00 at 6% for 8 Months**

Point off 2 places = \$346.00, the interest for 2 months.

Money at interest at 6% per year is equivalent to 1% for two months; therefore, pointing off two places in the principal gives the interest for two months.

8 months contain 4 multiples of 2.

Therefore  $346 \times 4 = \$1384$ . Interest for 8 months.

**To Obtain Interest at 6% for 6 Days.**

Point off 3 places of the principal.

As 6 days is 1/10 of 60 days, or two months, pointing off three places in the principal gives the interest for 6 days.

**Interest on \$476.28 at 6% for 24 Days.**

Point off 3 places = \$.476, interest for 6 days.

24 days contain 4 multiples of 6 days.

Therefore, hold over Fixed Decimal .476 for key factor and multiply 4 times = \$1.90, interest for 24 days.

This method is very good for figuring interest on "Anticipations" in Wholesale Houses.

Goods are purchased on time and the house wishes to make payment before the bills are due.

**EXAMPLE:**

UNITED STATES DRY GOODS CO. Bought of BING MFG. CO. Statement May 1/12				
Date	Terms	Amt.	Date Due	Days Int.
3/16	90 ds. 1/10	462.75	6/16	39
3/20	90 ds. 2/10	87.34	6/20	43
3/27	60 ds. net	326.85	5/27	20
4/5	4 mo. net	834.71	8/5	88
4/18	60 ds. net	19.28	6/18	41
		<u>1731.43</u>		

173093

To be paid May 5th at 6% discount.

Allowing 2 days for checks to reach destination.

**METHOD**

Determine the Interest Days for each item.

The days from May 7th to each due date on 30 day basis, i. e.,

23 ds. in May  
16 " " June  
39 etc.

Point off 3 places in each Principal and hold this as key factor over the Fixed Decimal. It represents the interest for 6 days. Multiply by 1-6 of the number of days, i. e.,

$463 \times 6.5$   
 $.087 \times 7.167$   
 $.327 \times 3.333$   
 $.835 \times 14.667$   
 $.019 \times 6.833$

173093 17.10

1731.43

less \$ 17.10

1714.33 Net amount to remit.

If the interest is 4%, 4½%, 5%, etc., multiply this result by the Decimal such % is of 6—  
4% = 66⅔%; 4½% = 75%; 5% = 83⅓%, etc.

Or,

Use the First Interest Formula

Principal by days by rate per day

$462.75 \times 39$   
 $87.34 \times 43$   
 $326.85 \times 20$   
 $834.71 \times 88$   
 $19.28 \times 41$

Equivalent Earning Time of \$1.00, 102,584.83 days

$102585 \times .0001667$  (Rate per day) = \$17.10

**INTEREST ON \$1.00 FOR 1 DAY AT 1 TO 12½%**  
(365 DAY YEAR)

		1/8%	1/4%	3/8%	1/2%	5/8%	3/4%	7/8%	
		.00000342 <sup>466</sup>	.00000684 <sup>932</sup>	.00001027 <sup>397</sup>	.00001369 <sup>863</sup>	.00001712 <sup>329</sup>	.00002054 <sup>795</sup>	.00002397 <sup>260</sup>	
1%	.00002739 <sup>726</sup>	.00003082 <sup>192</sup>	.00003424 <sup>658</sup>	.00003767 <sup>123</sup>	.00004109 <sup>589</sup>	.00004452 <sup>055</sup>	.00004794 <sup>521</sup>	.00005136 <sup>986</sup>	1%
2%	.00005479 <sup>452</sup>	.00005821 <sup>918</sup>	.00006164 <sup>384</sup>	.00006506 <sup>849</sup>	.00006849 <sup>315</sup>	.00007191 <sup>781</sup>	.00007534 <sup>247</sup>	.00007876 <sup>712</sup>	2%
3%	.00008219 <sup>178</sup>	.00008561 <sup>644</sup>	.00008904 <sup>110</sup>	.00009246 <sup>575</sup>	.00009589 <sup>041</sup>	.00009931 <sup>507</sup>	.00010273 <sup>973</sup>	.00010616 <sup>438</sup>	3%
4%	.00010958 <sup>904</sup>	.00011301 <sup>370</sup>	.00011643 <sup>836</sup>	.00011986 <sup>301</sup>	.00012328 <sup>767</sup>	.00012671 <sup>233</sup>	.00013013 <sup>699</sup>	.00013356 <sup>164</sup>	4%
5%	.00013698 <sup>630</sup>	.00014041 <sup>106</sup>	.00014383 <sup>562</sup>	.00014726 <sup>027</sup>	.00015068 <sup>493</sup>	.00015410 <sup>959</sup>	.00015753 <sup>425</sup>	.00016095 <sup>890</sup>	5%
6%	.00016438 <sup>340</sup>	.00016780 <sup>822</sup>	.00017123 <sup>288</sup>	.00017465 <sup>753</sup>	.00017808 <sup>219</sup>	.00018150 <sup>685</sup>	.00018493 <sup>151</sup>	.00018835 <sup>616</sup>	6%
7%	.00019178 <sup>082</sup>	.00019520 <sup>548</sup>	.00019863 <sup>014</sup>	.00020205 <sup>480</sup>	.00020547 <sup>945</sup>	.00020890 <sup>411</sup>	.00021232 <sup>877</sup>	.00021575 <sup>342</sup>	7%
8%	.00021917 <sup>808</sup>	.00022260 <sup>274</sup>	.00022602 <sup>740</sup>	.00022945 <sup>205</sup>	.00023287 <sup>671</sup>	.00023630 <sup>137</sup>	.00023972 <sup>603</sup>	.00024315 <sup>068</sup>	8%
9%	.00024657 <sup>534</sup>	.00024999 <sup>999</sup>	.00025342 <sup>466</sup>	.00025684 <sup>931</sup>	.00026027 <sup>397</sup>	.00026369 <sup>863</sup>	.00026712 <sup>329</sup>	.00027054 <sup>794</sup>	9%
10%	.00027397 <sup>260</sup>	.00027739 <sup>726</sup>	.00028082 <sup>192</sup>	.00028424 <sup>657</sup>	.00028767 <sup>123</sup>	.00029109 <sup>589</sup>	.00029452 <sup>055</sup>	.00029794 <sup>520</sup>	10%
11%	.00030136 <sup>986</sup>	.00030479 <sup>452</sup>	.00030821 <sup>918</sup>	.00031164 <sup>384</sup>	.00031506 <sup>849</sup>	.00031849 <sup>315</sup>	.00032191 <sup>781</sup>	.00032534 <sup>247</sup>	11%
12%	.00032876 <sup>712</sup>	.00033219 <sup>178</sup>	.00033561 <sup>644</sup>	.00033904 <sup>110</sup>	.00034246 <sup>515</sup>	.00034589 <sup>041</sup>	.00034931 <sup>507</sup>	.00035273 <sup>972</sup>	12%

**EXAMPLE:**

\$725.00 for 97 days at 6½% on 365 day year.

$$725 \times .000178 \times 97 = \$12.52$$

Note—When the principal is small and the period of time short, the use of only three or four decimal figures is necessary.

**EXAMPLE:**

Find the Interest on \$679.00 for 2 years, 7 months, 17 days at 7%, 360 day year.

First determine the number of days—

Add in the days	17
Hold 30 days×7 months	210
Hold 360 days×2 years	<u>720</u>

Accumulating, equals 947

$$679.00 \times .00019444 \times 947 \text{ days} = \$125.03$$

**EXAMPLE:**

Found in Bankers' and Brokers' Offices.

\$150,000.00 for 7 days at 4½%, 360 day year.

**METHOD**

Use the Principal for the key factor at the left of keyboard, working to the right multiply the rate per 1 day;  $150,000 \times 1145833 = 17.187+$ .

Point off, from the left, as many register holes as the net **whole numbers** in both factors.

150000 has 6 whole numbers  
.00011458 has 3 negatives

Equals 3 net whole numbers.

Leave this in the Register and multiply by 7 the number of days (using 6 key, see 3 factor work) = \$120.31.

### PROBLEM BASED ON 365 DAY YEAR

#### EXAMPLE:

Find the Interest on \$472.00 at 7%, from April 22nd, 1910, to August 15th, 1912, on the basis of a 365 day year.

#### METHOD

To determine the number of days:

Hold 365 days per year and add for each full year—

365 + 365 ..... 730 days

Then, add for the balance of

April ..... 8 "

May ..... 31 "

June ..... 30 "

July ..... 31 "

August ..... 15 "

Equals a Total of ..... 845 "

#### METHOD

Principal, \$472.00 × Rate per Day, .00019178

..... .09052016

Then, multiply this result by the days,

.09052016 × 845 ..... \$76.49

In both multiplications, work from the left of the keyboard and hold the Principal and the Days for the key factors.

### INSURANCE INTEREST

Figuring interest on loans on policies in Policy Loan Department.

Figured on a basis of 365 days.

#### FORMULA:

Is the same as the preceding—

Principal × number of days × rate per day.

#### INTEREST TABLE

Giving Interest on \$1.00 for 1 Day at the Several Rates.  
365 Day Year.

%		1/4%	1/2%	3/4%
		.00000684 <sup>932</sup>	.00001369 <sup>864</sup>	.00002054 <sup>796</sup>
1	.00002739 <sup>726</sup>	.00003424 <sup>658</sup>	.00004109 <sup>589</sup>	.00004794 <sup>521</sup>
2	.00005479 <sup>452</sup>	.00006164 <sup>384</sup>	.00006849 <sup>315</sup>	.00007534 <sup>247</sup>
3	.00008219 <sup>178</sup>	.00008904 <sup>110</sup>	.00009589 <sup>041</sup>	.00010273 <sup>973</sup>
4	.00010958 <sup>904</sup>	.00011643 <sup>836</sup>	.00012328 <sup>767</sup>	.00013013 <sup>699</sup>
5	.00013698 <sup>630</sup>	.00014383 <sup>562</sup>	.00015068 <sup>493</sup>	.00015753 <sup>425</sup>
6	.00016438 <sup>356</sup>	.00017123 <sup>288</sup>	.00017808 <sup>219</sup>	.00018493 <sup>151</sup>
7	.00019178 <sup>082</sup>	.00019863 <sup>014</sup>	.00020547 <sup>945</sup>	.00021232 <sup>877</sup>
8	.00021917 <sup>808</sup>	.00022602 <sup>740</sup>	.00023287 <sup>671</sup>	.00023972 <sup>603</sup>
9	.00024657 <sup>534</sup>	.00025342 <sup>466</sup>	.00026027 <sup>397</sup>	.00026712 <sup>329</sup>
10	.00027397 <sup>260</sup>	.00028082 <sup>192</sup>	.00028767 <sup>123</sup>	.00029452 <sup>055</sup>
11	.00030136 <sup>936</sup>	.00030821 <sup>868</sup>	.00031506 <sup>799</sup>	.00032191 <sup>731</sup>
12	.00032876 <sup>712</sup>	.00033561 <sup>644</sup>	.00034246 <sup>575</sup>	.00034931 <sup>507</sup>

#### EXAMPLE:

Interest on a loan of \$325.00 for 267 days at 5%.

325 × .0001369863 (as .000137) × 267 = \$11.89

## INTEREST BY FIXED DECIMAL METHOD USING THE MONTH AND DECIMAL OF MONTH

### 360 DAY YEAR

The regular rule is:

$$\frac{\text{Prin.} \times \text{Days} \times \text{Rate}}{360}$$

Then, converting the days to months it becomes:

$$\frac{\text{Prin.} \times \text{Months} \times \text{Rate}}{12}$$

Inasmuch as the rate can readily be divided by 12, i. e., 5% = 5/12 or .4167; 7% = 7/12 or .5833, the rule finally becomes:

$$\text{Prin.} \times \frac{\text{Rate}}{12} \times \text{Months} = \text{Interest.}$$

#### EXAMPLE:

Find the Interest on \$465.00 for 9 months, 16 days @  $4\frac{1}{2}\%$ .

(A) Divide the rate by 12.

Add .045 in the Comptometer at the left and divide by 12 = .00375.

Or refer to the table herewith. The decimal is found at the junction of 12 and  $4\frac{1}{2}$ .

Reduce the days to decimals of a month.

Divide the days by 30 or point off one place and divide by 3.

$$\text{i. e., } 16 \text{ days} = \frac{16}{30} = .53\frac{1}{3} \text{ Mo.}$$

$$9 \text{ Mo. } 16 \text{ days} = 9\frac{16}{30} \text{ or } 9.5333 \text{ Mo.}$$

### SHORT COMPTOMETER METHOD

(With 12-Column Comptometer)

Hold the Principal, \$465.00, for Key Factor, in the **Adding Position** (3rd, 4th and 5th columns) and multiply the rate, divided by 12, (.00375, used as 375).<sup>\*</sup> Multiply towards the right. This gives \$1.74375, in the Fixed Decimal position, the Interest for One Month.

Now, hold the registered amount for Key Factor over itself and multiply the months and decimal, i. e., 9.5333, (Fixed Decimal Method). This amount being in the register once, multiply but eight times in the first position. Split the multiplier and use 174 first, then 375 = \$16.62, in the Fixed Decimal position.

<sup>\*</sup> This is the same as using the Fixed Decimal Method and moving to the right for the decimals.

## BUILDING AND LOAN

Some Building and Loan Associations have accounts on which Interest is to be figured **monthly** for a **30-day month**, and, at times, for fractions of a month.

## EXAMPLE:

A house is sold, February 1st, for \$2700.00. The purchaser agrees to pay \$40.00 per month, plus accrued interest at 7%. An occasional payment is delayed and the interest must be figured at the time of payment.

March 1st—Paid \$40.00 and Interest on \$2700.00 for 1 month.

April 1st—Paid \$40.00 and Interest on \$2660.00 for 1 month.

May 8th—Paid \$40.00 and Interest on \$2620.00 for 1 month, 8 days.

June 1st—Paid \$40.00 and Interest on \$2580.00 for 22 days.

August 17th—Paid \$75.00 and Interest on \$2540.00 for 2 months, 17 days.

Sept. 17th—Paid \$40.00 and Interest on \$2465.00 for 1 month.

What amount of interest is required with each payment?

## METHOD

Multiply the Principal by the Interest on \$1.00 for 30 days (see Table).

Hold the Principal, \$2700.00, for Key Factor in the **adding position** and multiply by 5833, towards the right. This leaves the Interest for one month registered in the **Fixed Decimal Position**.

.0058333 × \$2700.00 . . . . . \$15.75, Due Mar. 1st.

.0058333 × 2660.00 . . . . . 15.52, Due Apr. 1st.

## Interest on \$2620.00 for One Month and 8 Days.

First figure the interest for one month.

.005833 × 2620.00 . . . . . \$15.28

Now clear the machine and multiply this by the months and decimal of a month.

1.267 × 15.28, split the multiplier . . . . . = \$19.36

## OR

With the interest for one month, figured, leave the amount, \$15.28, in the Fixed Decimal Position and multiply 15.28 by the remaining decimal of a month, .267, using the Fixed Decimal Method. This will automatically add the interest for the 8 days to the interest for 1 month . . . = \$19.36

INTEREST ON \$1.00 FOR ONE MONTH (30) DAYS, AT  $\frac{1}{8}\%$  TO 12%

		1%	2%	3%	4%	5%	6%	7%	8%	9%	10%	11%
		.000833	.001667	.002500	.003333	.004167	.005000	.005833	.006667	.007500	.008333	.009167
$\frac{1}{8}\%$	.000104	.000938	.001771	.002604	.003438	.004271	.005104	.005938	.006771	.007604	.008438	.009271
$\frac{1}{4}\%$	.000208	.001042	.001875	.002708	.003542	.004375	.005208	.006042	.006875	.007708	.008542	.009375
$\frac{3}{8}\%$	.000313	.001146	.001979	.002813	.003646	.004479	.005313	.006146	.006979	.007813	.008646	.009479
$\frac{1}{2}\%$	.000417	.001250	.002083	.002917	.003750	.004583	.005417	.006250	.007083	.007917	.008750	.009583
$\frac{5}{8}\%$	.000521	.001354	.002188	.003021	.003854	.004688	.005521	.006354	.007188	.008021	.008854	.009688
$\frac{3}{4}\%$	.000625	.001458	.002292	.003125	.003958	.004792	.005625	.006458	.007292	.008125	.008958	.009792
$\frac{7}{8}\%$	.000729	.001563	.002396	.003229	.004063	.004896	.005729	.006563	.007396	.008229	.009063	.009896

## REAL ESTATE AND BUILDING AND LOAN

To find the total interest on a property for a given number of years at a specified rate.

### EXAMPLE:

A house sells for \$4565.00—and no cash payments are required.

To be paid in 5 equal annual payments at 7% interest.

### METHOD 1

Find the total amount of interest.

1st year pays Interest on		\$ 4565.00
2nd " " " "	\$4565—\$913 (Annual Payment)	3652.00
3rd " " " "	3652— 913 " "	2739.00
4th " " " "	2739— 913 " "	1826.00
5th " " " "	1826— 913 " "	913.00

Or equivalent of one year interest on \$13695.00  
at 7% equals.....\$958.65 Total Interest.

To find the Annual Payments:

Principal \$4565.00

Interest 958.65

\$5523.65 Total, Including Interest.

Divide by 5 for the annual amount payable:

5)\$5523.65

\$1104.73 Annual Amount Payable.

### METHOD 2—SHORTER

Formula for determining interest based on different payment periods.

$$\frac{\text{Principal} \times (\text{No. of Payments} + 1) \times \text{Rate}}{\left\{ \begin{array}{l} 2 \\ \text{if} \\ \text{Annual} \end{array} \right\} \left\{ \begin{array}{l} 2 \times 2 \\ \text{if Semi-} \\ \text{Annual} \end{array} \right\} \left\{ \begin{array}{l} 2 \times 4 \\ \text{if Quar-} \\ \text{terly} \end{array} \right\} \left\{ \begin{array}{l} 2 \times 12 \\ \text{if} \\ \text{M'nthly} \end{array} \right\} \left\{ \begin{array}{l} 2 \times 52 \\ \text{if} \\ \text{W'kly} \end{array} \right\}} = \text{Interest.}$$

### EXAMPLE:

A home sells for \$4565.00.

What is total interest at 7% based on 5 annual payments?

$$\frac{4565 \times 6 \times 7}{2} = 958.65 + 4565 = \frac{5523.65}{5} = \$1104.73 \quad \text{Annual Payment}$$

The same based on quarterly payments for 5 years. This equals 20 payments.

$$\frac{4565 \times 21 \times 7}{2 \times 4} = 838.82 + 4565 = \frac{5403.82}{20} = \$270.191 \quad \text{Quarterly Payment}$$

The same based on monthly payments for 5 years equals 60 payments.

$$\frac{4565 \times 61 \times 7}{2 \times 12} = 812.19 + 4565 = \frac{5377.19}{60} = \$89.62 \quad \text{Monthly Payment}$$



## INTEREST ON SAVINGS ACCOUNTS

The following is in use by some Banks:  
Interest at 3% is paid on each Month's deposits until the semi-annual period.

Interest at 3% per year is—

.0025	for 1 mo., expressed as	.25%
.005	for 2 mos., expressed as	.5%
.0075	for 3 mos., expressed as	.75%
.01	for 4 mos., expressed as	1%
.0125	for 5 mos., expressed as	1.25%
.015	for 6 mos., expressed as	1.5%

### METHOD

An Interest Slip is kept in the ledger opposite each account.

The Bookkeeper enters on this Interest Slip the net Balance of deposits for each month and multiplies it by the number of months that it will draw interest. These amounts are totaled and divided by 4, pointing off two places, which gives the Interest at 3%.

EXAMPLE:

July 1, 1913				Account No <u>1473</u>	Jan'y 1, 1914			
Mo	Deposits	%	Interest		Mo	Deposits	%	Interest
1	1875	6 1.5	112 50		1		6 1.5	
2		5 1.25			2		5 1.25	
3	67	4 1	268		3		4 1	
4	35	3 .75	105		4		3 .75	
5		2 .50			5		2 .50	
6	181	1 .25	181		6		1 .25	
Divide by 4			118 04		Divide by 4			
Credit \$			29 51		Credit \$			

### SAVINGS ACCOUNT INTEREST SLIP

#### COMPTOMETER WORK

Multiply the Net Balances by the number of months,  $1875 \times 6 = 11250$ , etc.

Add the extensions, = 11804

Divide by 4, or—multiply by Reciprocal,  $.25 = \$29.51$  Interest.

#### TO PROVE RESULTS

Multiply the monthly Net Balances by the interest rates for

corresponding periods. Accumulate the results.

$$\begin{array}{r}
 1875 \times 1.5 \\
 67 \times 1. \\
 35 \times .75 \\
 181 \times .25 \\
 \hline
 \$29.51
 \end{array}$$

For convenience in accumulating, these rates of interest are printed on the Interest Slip, as shown.

## COMPOUND INTEREST

This is Interest figured periodically on unpaid interest as well as on the Principal.

These Problems may be found occasionally in Railroad offices in figuring depreciation or in Banks and Trust Companies. The two tables following will aid in getting quick results in compound interest.

**THE VALUE OF \$1.00 COMPOUNDED ANNUALLY**

NO. 1		1 TO 40 YEARS					
YRS	%	3%	4%	4½%	5%	5½%	6%
1	1.05	1.035	1.04	1.045	1.05	1.06	1.06
2	1.060900	1.071225	1.081600	1.092025	1.102500	1.113025	1.123600
3	1.092707	1.103718	1.124864	1.141166	1.157625	1.174250	1.191016
4	1.125500	1.147523	1.169659	1.192819	1.216006	1.239219	1.262477
5	1.159274	1.187686	1.216655	1.246182	1.276282	1.306966	1.338244
6	1.194052	1.229255	1.265319	1.302260	1.340096	1.378839	1.418491
7	1.229874	1.272279	1.315932	1.360862	1.407100	1.453750	1.500825
8	1.266770	1.316809	1.368669	1.422101	1.477185	1.533025	1.589639
9	1.304773	1.362897	1.423512	1.486095	1.551328	1.618249	1.686000
10	1.343916	1.410599	1.480244	1.552969	1.628896	1.708048	1.789449
11	1.384254	1.459970	1.539454	1.622853	1.710359	1.798629	1.888799
12	1.425761	1.511069	1.601032	1.695881	1.795866	1.892126	1.989799
13	1.468534	1.563956	1.668074	1.772196	1.885649	1.994928	2.106000
14	1.512590	1.618695	1.735176	1.851945	1.979932	2.109904	2.226000
15	1.557967	1.675349	1.800944	1.935282	2.078928	2.396558	2.500000
16	1.604706	1.733986	1.872981	2.022370	2.182876	2.540352	2.650000
17	1.652948	1.794676	1.947900	2.113377	2.292018	2.692773	2.800000
18	1.702693	1.857489	2.025817	2.208479	2.406619	2.864339	2.950000
19	1.753950	1.922501	2.106849	2.307860	2.526950	3.025600	3.100000
20	1.806111	1.989789	2.191123	2.411714	2.653298	3.207136	3.250000
21	1.860298	2.059481	2.278768	2.520241	2.785963	3.399564	3.400000
22	1.916103	2.131512	2.369919	2.633562	2.925261	3.603537	3.550000
23	1.973587	2.206114	2.464716	2.752166	3.071524	3.819750	3.700000
24	2.032794	2.283328	2.563304	2.876014	3.225100	4.048935	3.850000
25	2.093778	2.363245	2.665836	3.005434	3.386355	4.291871	4.000000
26	2.156591	2.445959	2.772470	3.140679	3.556673	4.549353	4.150000
27	2.221289	2.531567	2.883369	3.282010	3.733456	4.822346	4.300000
28	2.287928	2.620172	2.998703	3.429700	3.920129	5.111687	4.450000
29	2.356566	2.711878	3.118661	3.584036	4.116135	5.418388	4.600000
30	2.427262	2.806794	3.243398	3.745318	4.321942	5.743491	4.750000
31	2.500080	2.905031	3.373133	3.913857	4.538039	6.088101	4.900000
32	2.575083	3.006708	3.508059	4.089981	4.764941	6.453387	5.050000
33	2.652335	3.111942	3.648381	4.274030	5.003189	6.840590	5.200000
34	2.731905	3.220960	3.794216	4.466362	5.253348	7.251025	5.350000
35	2.813862	3.333590	3.946089	4.667348	5.516015	7.686087	5.500000
36	2.898278	3.450266	4.103953	4.877378	5.791816	8.147252	5.650000
37	2.985227	3.571025	4.268090	5.096860	6.081407	8.635607	5.800000
38	3.074785	3.696011	4.438813	5.326219	6.385477	9.154252	5.950000
39	3.167077	3.825372	4.616366	5.568899	6.704751	9.703507	6.100000
40	3.262088	3.959260	4.801021	5.816365	7.039989	10.285718	6.250000

### EXAMPLE:

What annual sinking fund Deposit required, which, with interest compounded annually at 4% will retire \$400,000.00 Mortgage Bonds in 30 years.

### METHOD

Add the value of \$1.00 compounded for 1 year, \$1.00 for 2 years, \$1.00 for 3 years, etc., up to 30 years.

**PRINCIPAL, WHICH, COMPOUNDED ANNUALLY WILL PRODUCE \$1.00. 1 TO 40 YEARS**

NO. 2		PRODUCE \$1.00. 1 TO 40 YEARS					
YRS	%	3%	4%	4½%	5%	5½%	6%
1	0.970874	0.966184	0.961539	0.956938	0.952391	0.943396	0.938996
2	0.942596	0.933511	0.924556	0.915730	0.907030	0.889996	0.889996
3	0.915142	0.901945	0.888996	0.876297	0.863836	0.839619	0.839619
4	0.888487	0.871442	0.854804	0.838561	0.822703	0.792094	0.792094
5	0.862609	0.841975	0.821927	0.802451	0.783526	0.747258	0.747258
6	0.837484	0.813501	0.790335	0.767896	0.746215	0.704961	0.704961
7	0.813092	0.785991	0.759918	0.734029	0.710681	0.665057	0.665057
8	0.789409	0.759412	0.730690	0.705153	0.676389	0.627412	0.627412
9	0.766417	0.733751	0.702587	0.672904	0.644609	0.591599	0.591599
10	0.744094	0.708919	0.675564	0.643928	0.613915	0.558995	0.558995
11	0.722421	0.684946	0.649581	0.616199	0.584679	0.526788	0.526788
12	0.701380	0.661785	0.624897	0.589664	0.556897	0.496969	0.496969
13	0.680951	0.639404	0.600574	0.564272	0.530321	0.468839	0.468839
14	0.661118	0.617782	0.577475	0.539973	0.506068	0.442301	0.442301
15	0.641862	0.596891	0.556255	0.516720	0.481017	0.417265	0.417265
16	0.623167	0.576706	0.533908	0.494449	0.458112	0.393646	0.393646
17	0.605016	0.557204	0.513373	0.473176	0.436297	0.371364	0.371364
18	0.587396	0.538361	0.493628	0.452800	0.415521	0.350344	0.350344
19	0.570286	0.520156	0.474642	0.433502	0.396734	0.330513	0.330513
20	0.553676	0.502566	0.456337	0.414643	0.376890	0.310805	0.310805
21	0.537549	0.485671	0.438634	0.396787	0.358942	0.292415	0.292415
22	0.521893	0.469151	0.421955	0.379701	0.341850	0.277505	0.277505
23	0.506692	0.453286	0.405726	0.363350	0.325571	0.261797	0.261797
24	0.491934	0.437957	0.390122	0.347704	0.310068	0.246979	0.246979
25	0.477606	0.423147	0.375117	0.332731	0.295303	0.232999	0.232999
26	0.463695	0.408838	0.360689	0.318403	0.281241	0.219810	0.219810
27	0.450189	0.395012	0.346817	0.304691	0.267848	0.207368	0.207368
28	0.437077	0.381654	0.333478	0.291571	0.255094	0.195630	0.195630
29	0.424346	0.368748	0.320651	0.279015	0.242946	0.184557	0.184557
30	0.411987	0.356278	0.308319	0.267000	0.231377	0.174110	0.174110
31	0.399987	0.344230	0.296460	0.255502	0.220300	0.164255	0.164255
32	0.388337	0.332590	0.285058	0.244500	0.209866	0.154957	0.154957
33	0.377026	0.321343	0.274094	0.233971	0.199873	0.146186	0.146186
34	0.366045	0.310476	0.263552	0.223896	0.190355	0.137912	0.137912
35	0.355383	0.299977	0.253416	0.214254	0.181290	0.130105	0.130105
36	0.345032	0.289833	0.243569	0.205028	0.172657	0.122741	0.122741
37	0.334993	0.280032	0.234299	0.196199	0.164436	0.115793	0.115793
38	0.325226	0.270662	0.225285	0.187750	0.156605	0.109239	0.109239
39	0.315754	0.261613	0.216621	0.179666	0.149148	0.103056	0.103056
40	0.306587	0.252873	0.208289	0.171929	0.142046	0.097222	0.097222

We find the total value of a \$1.00 annual deposit for thirty years will be \$58.328336.

Then  $\$400,000 \div \$58.328336 = \$6857.73$ , which is the amount of annual deposit at 4% compound interest required to retire \$400,000 bonds in 30 years.

This proves out to \$400,000.00 as close as it is possible to get.

## FIGURING COMPOUND INTEREST ON THE COMPTOMETER INDEPENDENTLY OF THE TABLES

### EXAMPLE:

Find amount due at Compound Interest on \$432.60 for 4 years, 7 mo., 14 days, at 7%.

### METHOD

Add the Principal, \$432.60, in the Comptometer in the Fixed Decimal position. The Principal being in the Register is equivalent to having multiplied by 1; therefore, hold the Principal for Key Factor directly over itself and, moving to the right, multiply, (Fixed Decimal Method), by .07%, = \$462.88, the Principal and Interest the first year.

Again leave this amount in the Register and, holding same for Key Factor, multiply by .07%, as before, = \$495.28, Principal and Interest the second year. Continue in the same manner for the Principal and Interest for the succeeding years. The results will be:

\$529.95, for the 3rd year,

\$567.05, for the 4th year.

Jot down these results and clear the machine.

Now figure the Interest on \$567.05 for 7 mo., 14 days.

Add the days on the right of Keyboard.... 14 days

Multiply the months by the days per

month,—7×30.....210 days  
224 days

Hold the rate, .07, and multiply by \$567.05 \$39.69,  
Int. for 1 year.

Continue and multiply by 224 days, ~~8800.56~~

3-Factor Method ..... ~~8800.56~~

And then divide by 360.....\$24.70

Add.....567.05

\$591.75

If the Compound Interest alone is wanted:—

Subtract the original Principal.....\$432.60

Amount of Compound Interest.....159.15

### COMPOUNDING AMOUNTS FOR LONG PERIODS

Multiplying the "Compound" for any two numbers of years equals the "Compound" for the sum of those years.

For instance:

What will be the value of \$1.00 at 5%, compounded annually for 20 years?

### METHOD

The "Compound" at the end of 1 year is. \$1.05

For the "Compound" at the end of the second year, multiply from the left of the Keyboard— $1.05 \times 1.05$ ..... 1.1025

Clear and make all successive multiplications from left of Keyboard.

Compound for  
2 yrs. 2 yrs.  
 $1.1025 \times 1.1025$ .....1.215506 for 4 yrs.

Compound for  
4 yrs. 4 yrs.  
 $1.215506 \times 1.215506$ .....1.477455 " 8 yrs.

Compound for  
8 yrs. 4 yrs.  
 $1.477455 \times 1.215506$ .....1.795855 " 12 yrs.

Compound for  
12 yrs. 8 yrs.  
 $1.795855 \times 1.477455$ .....~~2.658444~~ " 20 yrs.  
~~1.795855~~ ~~2.658444~~

## CALCULATING ANNUITY CAPITAL

What amount deposited in a Bank to-day, at 5% interest, compounded annually, will allow for yearly withdrawals of \$5,760.00 for 20 years and a \$2,880.00 withdrawal at the end of 20½ years?

**First: Ascertain the Principal required to produce \$5,760.00 for 20 years at 5%.**

### METHOD

Turn to Table No. 2.

You will find the Principals required to **return \$1.00 each year** for 20 years.

Add these various Principals up to and including 20 years. . . . . = 12.4622073

As we want to produce \$5,760.00 each year for 20 years, multiply \$5,760.00 by 12.4622073, from the left of the Keyboard—\$71,782.31, Principal for 20 full years' withdrawals.

**Second: Ascertain the Principal required to produce \$2,880.00 in 20½ years at 5% compounded annually.**

Table No. 1 shows that \$1.00 at 5% in 20 years amounts to \$2.653298.

One half year at 5% is the same as one year at 2½%, so determine the compound for one year at 2½%, i. e., 2½% + 100%, or 1.025 × 2.653298, multiplying from the left of Keyboard equals . . \$2.719629, the value of \$1.00 in 20½ yrs. at 5%

**What Principal is required to produce \$2,880.00?**

Divide \$2,880.00 by the value of \$1.00,  
\$2.719629 . . . . . = \$1058.97

Add to this the Principal required required to produce \$5,760.00 annually for 20 years. . . . . 71,782.31

Equals Total Deposit required. . . . . \$72,841.28

## BRITISH WEIGHTS, MEASURES AND MONEY

The Denominations of British Money or "Sterling" are: Pounds (£), Shillings (s) and Pence (d).  
12d in one Shilling; 20s in one Pound.

The British Weights are: Tons (2240 lbs.), Cwts. (112 lbs.), Quarters (28 lbs.)

The most efficient manner of working up this class of data is with the £, s, d Model Comptometer.

Mr. Felt has made a Comptometer that is very effective in working up £, s and d data. The right side of the Keyboard is made to add pence and shillings, converting automatically into the next higher denominations.

While constructed in the 8, 10 and 12 column sizes the larger are the more practical, as the capacity is greater for the Fixed Decimal Method of making extensions and accumulations.

**ADDITION**  
**Adding Pounds, Shillings and Pence**

<b>EXAMPLE:</b>	£	s	d
	14	14	5
	17	14	5
	16	8	3 $\frac{1}{4}$
	9	0	3 $\frac{3}{4}$
	11	14	6 $\frac{1}{2}$
	—	—	—
	69	11	11 $\frac{1}{2}$

## WHERE THE ITEMS ARE TABULATED

**With £, s, d Model.**

Add in the regular order:

First the d in the pence columns,

Then the s in the shillings columns,

And the £ in the pounds columns.

Or reverse the order and first add the £, then the s and d.

The denominated answer shows in the Register,

£69, 11s, 11 $\frac{1}{2}$ d.

**With Regular Model.**

Add the d on the right side of Keyboard ..... =

23 $\frac{1}{2}$ d.

Divide by 12, changing to s and d =

1s-11 $\frac{1}{2}$ d.

Set off with a Decimal Pointer:

Add the shillings next to the d =

51s-11 $\frac{1}{2}$ d.

Divide by 20, changing to £ and s = £ 2-11s-11 $\frac{1}{2}$ d.

Add the Pounds. Answer ..... = £69-11s-11 $\frac{1}{2}$ d.

For convenience, separate the denominations with the pointers.

## WHERE THE ITEMS ARE ON SEPARATE SLIPS OR CARDS

**With £, s, d Model**

Add in the order you read, i. e.

Add the £14 in the pounds columns.

Then 14s and the 5d in their columns, continuing in this manner with each item.

Answer: £69, 11s, and 11 $\frac{1}{2}$ d.

**With Regular Model, 10 or 12 Column.**

Set off separate columns for £ s d  
£, s, and d with the pointers, as ... 000'000'00000

Add each denomination in the allotted columns. .... = 067'050'023.50

Now convert the d to s. Divide by 12 and use the intervening small cipher key to carry the s into the shillings columns. .... = 067'051'000'11 $\frac{1}{2}$

Then convert the s in the same manner, dividing by 20:—Ans... £69-11s-11 $\frac{1}{2}$ d.

### CONVERTING £, s AND d TO DECIMALS OF A £

#### SHILLINGS

1 s is 1/20th or .05 of a £.

Therefore number of s  $\times$  .05 = hundredths of a £.

Thus 17s is  $17 \times .05 = \text{£}.85$

11s is  $11 \times .05 = \text{£}.55$

3s is  $3 \times .05 = \text{£}.15$

19s is  $19 \times .05 = \text{£}.95$

#### CONVERTING MENTALLY

EXAMPLE:

Convert 3s, 6d to decimals of a £.

Multiply mentally:

$$8 \times .05 = \text{£}.15$$

$$6 \times .004\frac{1}{2} = .025$$

$$\text{£}.175$$

$$17s, 9d = 17 \times .05 = \text{£}.85$$

$$9 \times .004\frac{1}{2} = \text{£}.037\frac{1}{2}$$

$$\text{£}.8875$$

#### CONVERTING ON THE COMPTOMETER

EXAMPLE:

75 buggies @ £26, 17s, 6d.

Use 75 for Key Factor over the Fixed Decimal and multiply, changing the s and d to decimals, mentally, as you multiply; i. e., holding 75, multiply 26.

$$\text{Then, } .85 (17 \times 5)$$

$$\text{Then, } .025 (6 \times 4\frac{1}{2}) \quad \text{£}2015.625$$

This makes one continuous multiplication towards the right.

#### CONVERTING THROUGH USE OF TABLE

EXAMPLE:

75 Buggies @ ~~£25~~ <sup>£26</sup>, 17s, 6d.

Look at the table on the following page at the junction of 17s and 6d.

The decimal is .875.

Hold 75 over the Fixed Decimal and multiply—

$$\text{£}26.875 = \text{£}2015.625$$

#### PENCE

1d is  $\frac{1}{240}$ th or .004 $\frac{1}{2}$  of a £, therefore, number of pence  $\times$  .004 $\frac{1}{2}$  = thousandths of a £.

$$\text{Thus, } 6d \times 4\frac{1}{2} = \text{£}.025$$

$$3d \times 4\frac{1}{2} = \text{£}.012\frac{1}{2}$$

$$7d \times 4\frac{1}{2} = \text{£}.029\frac{1}{2}$$

$$11d \times 4\frac{1}{2} = \text{£}.045\frac{1}{2}$$

EXAMPLE:

Convert 17s, 9d to decimals of a £.

Hold the Decimal for 1s, .05, over Fixed Decimal, and multiply by the number of s:

$$17 \times .05$$

Then the decimal for 1d, .00417 by the number of d accumulating,  $9 \times .00417 = .88753$ .

## CONVERTING MENTALLY

Divide the remaining **Thousandths** by  $4\frac{1}{8} = d$ .

**EXAMPLE:** £37.629 = ?      £143.7876 = ?  
5 into .62 = 12s.  
4½ into .029 = 7d.  
i. e., £37, 12s, 7d.  
5 into 78 = 15s.  
4½ into .0376 = 9d.  
i. e., £143, 15s, 9d.

Divide first two decimal places by 5 for shillings. Divide the remainder of 2nd and 3rd decimal place by 4. If it is over 12, deduct 1, if over 36 deduct 2 before dividing. This gives pence.

**For Use in Figuring Sterling Bills, Invoices, Freight Bills, Exchange, etc.**  
**If Price Contains  $\frac{3}{4}$  d. add .002 to following Decimals**

		1 d	2 d	3 d	4 d	5 d	6 d	7 d	8 d	9 d	10 d	11 d	
		.0042	.0083	.0125	.0167	.0208	.025	.0292	.0333	.0375	.0417	.0458	
1 s	.06	.0642	.0683	.0625	.0667	.0708	.075	.0792	.0833	.0875	.0917	.0958	1 s
2 s	.1	.1042	.1083	.1125	.1167	.1208	.125	.1292	.1333	.1375	.1417	.1458	2 s
3 s	.15	.1542	.1583	.1625	.1667	.1708	.175	.1792	.1833	.1875	.1917	.1958	3 s
4 s	.2	.2042	.2083	.2125	.2167	.2208	.225	.2292	.2333	.2375	.2417	.2458	4 s
5 s	.25	.2542	.2583	.2625	.2667	.2708	.275	.2792	.2833	.2875	.2917	.2958	5 s
6 s	.3	.3042	.3083	.3125	.3167	.3208	.325	.3292	.3333	.3375	.3417	.3458	6 s
7 s	.35	.3542	.3583	.3625	.3667	.3708	.375	.3792	.3833	.3875	.3917	.3958	7 s
8 s	.4	.4042	.4083	.4125	.4167	.4208	.425	.4292	.4333	.4375	.4417	.4458	8 s
9 s	.45	.4542	.4583	.4625	.4667	.4708	.475	.4792	.4833	.4875	.4917	.4958	9 s
10 s	.5	.5042	.5083	.5125	.5167	.5208	.525	.5292	.5333	.5375	.5417	.5458	10 s
11 s	.55	.5542	.5583	.5625	.5667	.5708	.575	.5792	.5833	.5875	.5917	.5958	11 s
12 s	.6	.6042	.6083	.6125	.6167	.6208	.625	.6292	.6333	.6375	.6417	.6458	12 s
13 s	.65	.6542	.6583	.6625	.6667	.6708	.675	.6792	.6833	.6875	.6917	.6958	13 s
14 s	.7	.7042	.7083	.7125	.7167	.7208	.725	.7292	.7333	.7375	.7417	.7458	14 s
15 s	.75	.7542	.7583	.7625	.7667	.7708	.775	.7792	.7833	.7875	.7917	.7958	15 s
16 s	.8	.8042	.8083	.8125	.8167	.8208	.825	.8292	.8333	.8375	.8417	.8458	16 s
17 s	.85	.8542	.8583	.8625	.8667	.8708	.875	.8792	.8833	.8875	.8917	.8958	17 s
18 s	.9	.9042	.9083	.9125	.9167	.9208	.925	.9292	.9333	.9375	.9417	.9458	18 s
19 s	.95	.9542	.9583	.9625	.9667	.9708	.975	.9792	.9833	.9875	.9917	.9958	19 s
		1 d	2 d	3 d	4 d	5 d	6 d	7 d	8 d	9 d	10 d	11 d	

**Add the decimal in the Fixed Decimal position, .625. Divide the Hundredths, .62, by 5, using the Cipher Method. = 12.025s.**

Divide the remaining **Thousandths**, .025, by  $4\frac{1}{2}$ , (regular division) i. e.,  $4.2 = 12s, 6d$ .

**EXAMPLE:**  $14@_{\mathcal{L}}7, 14s, 11d$  each =  
 $14 \times 7.746$  = 108.444  
 Subtract the  $\mathcal{L}$   $\frac{108.}{108.}$   
 $\mathcal{L} \quad .444$

Divide the **Hundredths**, .44 by 5, using the Cipher method = 8s.

Divide, in regular manner, the remaining **Thousandths** by 4.2 ( $4\frac{1}{5}$ ) = 8s, 10d.

The adjoining table contains the decimals of a  $\mathcal{L}$  for all  $s$  and  $d$  quantities.

**EXAMPLE:**

**17s, 7d. Convert to a Decimal.**

Look on the table at the junction  
of 17s and 7d, £.8792.

£.7876. Convert to s and d.

Look in decimal column next to shillings for nearest to .78. Follow out on this line to nearest decimal, .7875, which shows 15s, 9d.

## DIVISION OF £, s AND d

Convert the s and d into decimals of a £, and reconvert after dividing.

EXAMPLE:

46 wagons cost £392, 14s, 9d. What is cost of each?  
 Convert to £ and decimals.  
 Add the £ in Fixed Decimal Position..... 392.  
 Multiply the s by decimal,  $14 \times .05$ ..... = .70  
 Multiply the d by decimal,  $9 \times .00417$ ..... = .03753  
 £392.73753

Divide 392.73753 by 46 = £8.5378 or £8, 10s, 9d.

Or better,— look at Decimal Table on preceding page at junction of 14s and 9d = decimal .7375. Then add the £392.7375 in the Comptometer at the left and divide by 46.

EXAMPLE:

The profit is £134, 17s and 7d. Amount of sales is £536, 16s, 5d.

What is per cent of profit?

Converting the Sales:

Add the £, 536, in the Comptometer in Fixed Decimal position.  
 Then multiply  $16 \times .05$  (16s)  
 and  $5 \times .00417$  (5d) = 536.821

Convert the profit in the same manner = 134.879.

Add amount of profit in the Comptometer at the left and divide by selling price, £536.821 = 25.1%.

## DECIMALS OF A 360 DAY YEAR

MONTHS	DECIMAL.	DAYS	DECIMAL	DAYS	DECIMAL
1	.083333	1	.002778	16	.044444
2	.166667	2	.005556	17	.047222
3	.250000	3	.008333	18	.050000
4	.333333	4	.011111	19	.052778
5	.416667	5	.013889	20	.055556
6	.500000	6	.016667	21	.058333
7	.583333	7	.019444	22	.061111
8	.666667	8	.022222	23	.063889
9	.750000	9	.025000	24	.066667
10	.833333	10	.027778	25	.069444
11	.916667	11	.030556	26	.072222
		12	.033333	27	.075000
		13	.036111	28	.077778
		14	.038889	29	.080556
		15	.041667		

## INTEREST

Find the interest on £325, 15s, 6d @ 5% for 287 days.

Convert to £ = 325.75  
 .025  
 £325.775

Princ.  $\times$  Rate  $\times$  Days  
 360 (365) = Interest.

$325.775 \times .05 \times 287$   
 360 (365) = £12.98 = £12, 19s, 8d.

Or better — Use the Interest Table and multiply.

Princ. Rate Days  
 $325.775 \times .00013889 (+) \times 287 = £12.98$  Interest.

Multiply from the left of Keyboard. Use the Principal, splitting it, for the Key Factor. Note the result, clear, then hold the days for Key Factor and again multiply from the left.

EXAMPLE:

Find the interest on:

£465, 10s, 6d for 2 yrs., 7 mo., 16 days @  $3\frac{1}{2}\%$

Convert Principal to £ = 465.50  
 .025

£465.525  
 Convert time to days,  $360 \times 2 = 720$   
 $30 \times 7 = 210$   
 16

i. e., 946 days.

Holding 360, add in repeatedly for the number of years. Over it multiply the months by 30 and add in the days.

Then formula is: Princ.  $\times$  years and decimals  $\times$  rate = Interest.

Or convert time into years and decimals..... = 2.5833  
 .0444

2.6277

Use the "Decimals of a Year" table for converting months and days.

$£465.525 \times .035 \times 2.6277 = £42.82$ , or £42, 16s, 3d.



### ADDING TONS, CWTS., QRS. AND LBS.

EXAMPLE:

Tons	Cwts.	Qrs.	Lbs.
116	12	3	19
18	2	2	25
56	11	0	12
72	8	3	18
124	19	2	16
64	15	3	17
19	3	1	28
472	14	2	23

Note the relationship between £, s, and d, and Tons, Cwts., and Qrs.

20 Cwt. = 1 Ton } Therefore add the Cwts. in the  
 20s = 1£ } shillings column.  
 4 Qrs. = 1 Cwt. } Therefore adding 3 in the d  
 12d = 1 s. } column is equivalent to adding  
 one Quarter.

In adding quarters:

Add 1 Qr. on the 3 d key.

Add 2 Qr. on the 6 d key.

Add 3 Qr. on the 9 d key.

Or use the 3 d key repeatedly, adding twice for 2 Qrs. and three times for 3 Qrs.

### WHERE THE ITEMS ARE TABULATED

With £, s, d Model.

First add the lbs. in the £ columns = 135 lbs.

Convert into Qrs. i. e.,

Divide by 28 = 4 Qrs., 23 lbs.

Jot down the 23 lbs. Clear the machine.

Add the 4 Qrs. as 1 Cwt. in the s column.

Continuing, add the Qrs. in the d columns; then the Cwt. in the s columns, and the tons in the £ columns.

= 472 tons, 14 Cwt., 2 Qrs., 23 lbs.

With Regular Model.

Add the lbs. in right side of Keyboard and convert = 4 Qr. 23 lbs.

Set off by pointer.

Then add the Qrs. next to the lbs. and convert = 18 Qr. 23 lbs.

Or, 4 Cwt., 2 Qr., 23 lbs.

Then add the Cwts.

and convert. = 3 tons, 14 Cwt., 2 Qrs., 23 lbs.

Then add the tons,

= 472 tons, 14 Cwts., 2 Qrs., 23 lbs.

### WHERE THE ITEMS ARE ON SEPARATE SLIPS OR CARDS

With £, s, d Model.

Set off 2 or 3 columns at the left of Keyboard for the lbs. and then add the Tons, Cwts. and Qrs. in their respective columns in the same order as you read them, and the lbs. at the left.

Convert the lbs. before clearing.

If the lbs. item occupies the last register hole, jot down the entire answer, clear the machine and add this lbs. item, at the right, and convert, i. e., divide by 28.

Answer 472 tons, 14 Cwt., 2 Qrs., 23 lbs.

With Regular Model.

Set off with the pointers as many columns as needed for each denomination, as

Tons Cwt. Qrs. Lbs.

000' 000' 000' 000.

Then add each denomination in the allotted columns, i. e.,

116 T 12 Cwt. 3 Qr. 19 lb.

18 T 2 Cwt. 2 Qr. 25 lb.

etc., etc.

Ans. 469 T 70 Cwt. 14 Qr. 135 lb.

Now convert the lbs., then the Qrs., and the Cwts., using intervening small cipher keys when reducing to carry the converted item into its denomination.



# **COMPTOMETER APPLICATION**

## THE COMPTOMETER IN BOOKKEEPING

The Comptometer affords the ways and means of getting accurate results in the most rapid and efficient manner; it arrives at results **direct** from the **original** data with the least possible copying of that data.

From 60 to 90% of the adding in an office balances one column or book against another.

Additions, not balancing one column or book against another, are proven by the **direct re-adding** of the **original figures**. The only certain proof of addition is re-addition.

The Comptometer gives the Bookkeeper more time to devote to other important work, which means, for him, greater capacity and, consequently, more rapid advancement.

The Bookkeeper can turn out from 20 to 200% more work in the day's run in additions, extensions and percentages with the aid of the Comptometer than by any other method,—

Because of its **single, simple operation** of pushing the keys down, reading the results directly;

Because of the **ease of operating** with Conscious Accuracy;

Because his **undivided attention** is given to simply transferring to the keys the amounts being added;

Because he can soon **develop a speed** one to three times that of any other method;

Because of the **conservation of Brain Energy**, which will be utilized on other important details.

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Results Direct from the Original Data.

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### BOOKKEEPING CHART

There are many different plans and ways of keeping accounts in general.

In the **final analysis** they are all boiled down to one common basis, which is, that the ledgers are the books of permanent record and contain the data of **all** the entries from the 4 primary sources—

Purchases

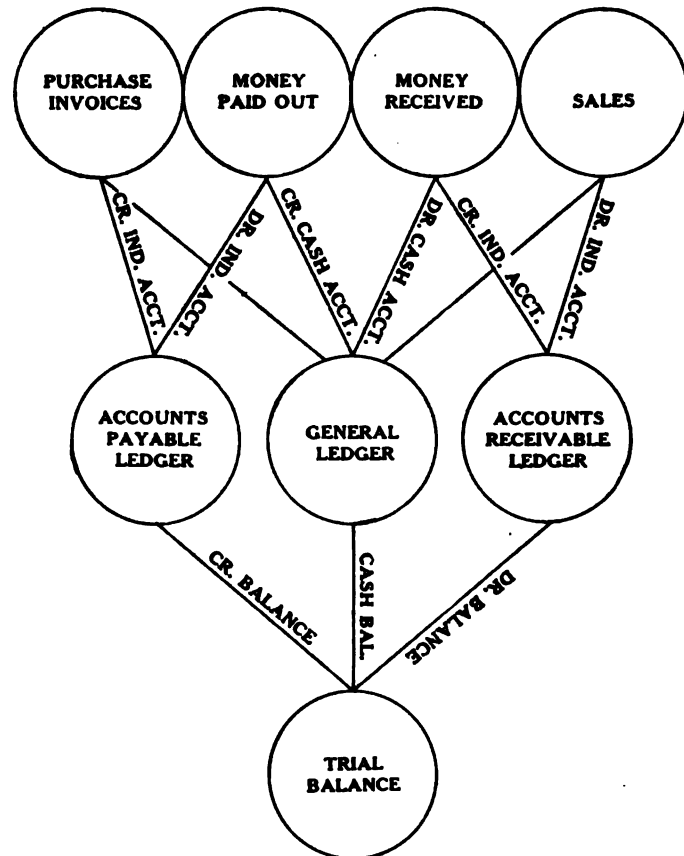
Moneys received

Money paid out

Sales

See accompanying chart. 🖱️

Having a common ground established for all general bookkeeping, see how **perfectly** the **Comptometer** applies to all of the work.



## PURCHASE INVOICES

### THE COMPTOMETER:—

- Adds the quantities.
- Figures the extensions.
- Proves the totals.
- Figures the discounts.
- Deducts the freight items, etc.
- Extends and adds at the same time.
- Here are **three classes of figure work**—
  - Extending
  - Adding
  - Deducting.

### THE COMPTOMETER:—

Figures the extensions by the **simple, multiple** depression of the keys.

Does the adding by simply pushing down the keys representing each amount to be added.

Makes the deductions by depressing the keys representing, negatively the amount to be subtracted, (indicated by the small figures on the key tops).

While extending several items over the Fixed Decimal, the machine automatically adds to a final total, thus **proving extensions and additions** with the **one operation**.

Applies with **equal facility** to **positively prove** every result.

Saves  $\frac{1}{3}$  to  $\frac{1}{2}$  of the usual time required by other methods.

The positive assurance of accuracy is one of the most valuable features.

## MONEY RECEIVED—MONEY PAID OUT

### THE CASHIER'S WORK BY THE COMPTOMETER METHOD

#### Proves the Postings to the Cash Book:—

Adds the **original** vouchers or cash slips and proves against the footings of the Cash Book.

#### Balances the Cash Book:—

By first adding the **Credit Postings**, then after clearing the machine, adding the **Debit Postings**. **Subtract** the **Credit** total and the balance proves against the cash on hand.

#### Totaling Checks:—

When adding a large number of checks say about 50 or more, at intervals of 25 to 30 checks, jot the Sub-total on a slip of paper and drop it in the pile of added checks. This simplifies the proving. The only **known proof** for addition is **re-addition**.

#### Add Deposit Slips:—

and prove by adding the checks independently and comparing results.

#### Figure Interest, Etc.

## SALES

### OUTGOING BILLING

The Comptometer again does all of this work by the simple operation of the keys alone.

**Direct results** in each operation the **instant** the **key travel** is **completed**.

- It    Figures the extensions
- Takes off the discounts,
- Adds the extensions,
- Deducts freight items, etc.

In proving the invoices, accumulate over the Fixed Decimal, where possible. The adding will be automatic and thus **proves** both the extensions and additions in the one operation.

This is one of the **most important features** of the business and the Comptometer easily increases the efficiency from **20 to 50%** in a few months of use.

The net results obtained are:—

- Unquestioned Accuracy,**
- Increased Efficiency,**
- Conservation of Individual Brain Energy.**

## LEDGER WORK

### PROVING DAILY POSTINGS BY THE COMPTOMETER METHOD

Bookkeepers have several different methods of proving the postings. One is using the Posting Slip. The bookkeeper enters the amount of each Debit and Credit on the Posting Slip at the same time as posting into the Ledger; then totals the Posting Slip and compares with the total of the original items.

Another method has been that of employing a Check Figure, but is now little used.

The Comptometer Method is that of using Debit and Credit Markers, and, when the posting is completed, adding **direct** from the items in the Ledger. This is, without question, the most **convenient** and **economical method** to the "Bookkeeper who knows."

The Bookkeeper can prove the daily postings in from five to ten minutes each day with the Comptometer and Debit and Credit Markers. This will give him that feeling which comes from a knowledge of work correctly done. It reduces the Trial Balance at the end of the month to a slight task and a comparative work of pleasure:

#### METHOD

Drop a Blue Debit Marker in the Ledger for each **Debit** posting as made. Then go through and add on the Comptometer the amount of each Debit posting indicated by the markers. Now, balance this result against the total of the original items posted.

Do the same with the **Credit** postings, using the Pink Credit Markers.

By proving the postings in this manner daily, the Ledger is always in balance. The time and effort required is very little and enables the detection at once of—

- Any posting to **wrong side** of account,
- Any posting of **wrong amount**,
- Any **transposition** of figures.

### LEDGER WORK—Continued—BALANCING LEDGER ACCOUNTS

The Comptometer affords the means of balancing Ledger Accounts with the minimum of effort and the maximum assurance of accuracy. The Subtraction Cut-Offs make it practically as easy to deduct an item as to add; hence the fact that the "Book-keeper who knows" balances his ledger with the Comptometer in from 20 to 50% less time than by any other method.

#### SAMPLE LEDGER PAGE

JOHN H. ALLEN									
DATE.	DR.	BAL.	CR.	DATE					
17 1	116.50		75.00	17 10					
17 3	478		348	17 10					
7	1774		87.00	17 14					
13	6675		87	16					
24	6274	10166	16635						
	26801								

#### METHOD

The Comptometer is placed on the desk close up beside the ledger.

Add the Credit side of the account, then the Debit, penciling in the totals.

With the Debit remaining in the machine, deduct the Credit—the result is the balance of the account.

Add back the Credit before clearing the machine, which again gives the total Debit, thus proving the balance.

### USING THE TWELVE COLUMN COMPTOMETER

With the twelve-column Comptometer, illustrated opposite, add the Credits on the Right Side and the Debits on the Left; then, with both Credit and Debit Totals showing in the Register, subtract the amount of the Credit from the Debit. The result is the Balance, which is entered in "Balance" column. Now, before clearing the machine, add back the Credit, which gives the total Debit, thus proving the Subtraction.

The valuable feature of this is that both the Debit and Credit Totals of the account are in the Register in front of the eyes until the Balance is obtained and the Subtraction proven.



12-COLUMN MODEL "E" COMPTOMETER, WITH DR. AND CR. COLUMN DIVIDOR

: :

: .

## TRIAL BALANCE

The Comptometer conserves a greater amount of **Brain Energy** for executive development than any other assistant.

Because it produces all figure results with the minimum of attention and effort on the part of the Bookkeeper.

Think of the perfect ease and adaptability of the Comptometer for **every step** of bookkeeping work—of the **positive proof of every result**.

Just drink in the Comptometer Sub-Total Method and it is plain to realize why and how the Comptometer user gets his Balance the first time month after month.

## OBJECT

The only object of a Trial Balance is to prove that the postings of corresponding amounts have been made to the Debit and Credit sides of the Ledger.

It is, in no-wise, proof against the manipulation of accounts, etc.

## METHODS

There are five distinct methods employed in the taking of Trial Balances. They are:—

Trial Balance by the Book Method,	
“ “ “ “ Sheet Method,	
“ “ “ “ List Method,	
“ “ “ “ Sub-Total Cards,	
“ “ “ “ Sectional Sub-Total Ledger Sheets.	



## THE TRIAL BALANCE BOOK

This is, perhaps, the oldest method of taking Trial Balances. The Trial Balance Book usually provides for the full year's monthly balances with the one writing of account names. A blank space is left at the end of each index letter for additional names, from time to time, through the year.

## ITS VALUE

The Trial Balance Book may be desired by the owner or proprietor as an aid in looking up the condition of his customers' accounts, this giving him a concise, rough and ready comparison of the account.

It entails:—

A copying of all account names in the Trial Balance Book;

The adding of new names as new accounts are opened in the Ledger;

The placing of these new accounts out of their alphabetical order; hence, sometimes difficult to locate in the Trial Balance Book;

Copying and writing down the amount of each Balance each month;

The adding of these items.

## METHOD

Place the Comptometer right beside the column. Add the items with the **simple, single action** of the **key depression** alone. Carry the totals from page to page, the final total being that of all Debit and Credit Balances, respectively, or enter each page total separately and make a final recapitulation.

If not balancing the first time, prove the additions by **re-adding the original items**.

The Trial Balance Book has been largely replaced by one of the following methods:

**TRIAL BALANCE BOOK**

The Comptometer is perfectly adapted for this form of Trial Balance. Placed right beside the column, it adds the items with the simple, single action of the key depression alone.

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### TRIAL BALANCE SHEETS

The Trial Balance Sheet Method is practically the same as the Book, with this exception: The names of all accounts and the amounts are copied on the sheets each month. This, of course, can be done on the typewriter and duplicate copies made.

The Comptometer again applies in the most simple manner possible to adding and proving this form of Trial Balance.

This method is used largely to have a carbon copy, so that the original Trial Balance may be sent to the home office and copy retained by the branch office.

### TRIAL BALANCE BY THE LIST METHOD

This is taking a Trial Balance by means of a printed list of the figures only. In case of errors, it means a lot of checking and comparing of a copied list of figures with the original amounts in the Ledger.

The list of figures, having no identifying information, is valueless as a record of the Trial Balance.

In using this list, all corrections are first attempted through checking and re-checking the printed list of figures — a laborious task at its best.

### LIST METHOD—Continued

This method of checking is not a positive proof. It is open to possibility of any of the three following errors:

1st. Overlooking a transposition of figures in checking back a printed list against the original figures. A transposition may be made, and, in the hurried checking, the eye seeing the same figures in one item as in another, frequently overlooks the transposition.

2d. Having an amount in the accumulator and failing to clear the machine, the total will be just that amount greater than the correct total. The items may all be correctly printed and added. They will check perfectly, leading to the conclusion that the total is correct, whereas it would contain the additional amount which was in the accumulator, and there would be no indication of it on the printed list.

3d. Having added the items but once, there is absolutely no proof against under or over-carrying in the operation of the machine.

Running total of Debit  
Balances        \$

Running total of Credit  
Balances        \$

### THE COMPTOMETER SUB-TOTAL METHOD

A method far in advance of any of the preceding and the simplest possible manner of proving the Ledger balance. It deals **direct with the original figures** in the Ledger. It goes to the fountain-head and adds the **original** items posted in the Ledger, section by section. It gives positive proof of the correct footing of each section before leaving it.

Note the simplicity of the Comptometer Sub-Total Method.

Every step is absolutely proven.

Add the **Debit** balances of several accounts, or an "Index Section" of the Ledger. Jot the result on a Sub-Total Card and drop it in the Ledger at this point. Continue with the debits of each of the following sections, dropping a Sub-Total Card containing the **running total** at the end of each Ledger Section. The last Sub-Total Card will, of course, show the **Total Debit**.

Add the Credits in like manner, or, if but a few, jot same on a pad while adding the Debits.

To get the **direct proof**, re-add the original figures and check mark each Sub-Total. In case of an error in any section, simply note the second result and **re-add that one section**, thus proving the correct amount.

Make any plus or minus correction on the last Sub-Total Card.

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## THE COMPTOMETER SUB-TOTAL TRIAL BALANCE SHEETS

### LEDGER SUB-TOTAL SHEET

Many business houses require a physical exhibit of each Trial Balance, to turn over to the Auditor when auditing the books and accounts. This method provides a running Sub-Total at the end of each Index Section on a Sub-Total Ledger Sheet, which remains permanently in the Ledger.


### METHOD

The loose leaf Ledger Sheets are ruled and printed for the Debit and Credit and Correction columns for each month. The Ledger is added, section by section, jotting down on these sheets the running Sub-Totals at the end of each Index Section. The Sub-Total on the last sheet, of course, contains the total of the Debits and Credits, or Debit and Credit Balances, as desired.

In case of overlooking an account in the first adding, or a failure to balance, for any reason—

The first step will be to prove the additions. Here the Comptometer affords absolutely the best known proof: Re-add the original ledger balances, check-marking each correct Sub-Total. If an error in any Sub-Total, note the amount of + or - in the "Correction" column and also on the last Sub-Total Sheet, referring to the Index Section where the correction was made.

---



MADE BY C.O.

DATE	DR.	CORRECTIONS	CR.	CORRECTIONS	DATE	DR.	CORRECTIONS	CR.	CORRECTIONS
	773340		943220		Jan.				
	1983/38	1000	1258832	1000	Feb.				
Mar.	3014234		2433120		Mar.				
					Apr.				
					May				
<p><b>We supply the Sub-Total Trial Balance Sheets to Comptometer users.</b></p> <p>Firms that have adopted this system are unstinted in their praise of it. The simplicity, the ease and the accuracy of the proof are especially inviting to the "bookkeeper who knows."</p> <p>The sheets are inserted in the loose-leaf ledger at the end of each index section; or, if there are only a few accounts to the index, insert one Sub-Total Sheet for several index sections. These will remain permanently in the ledger. If bound ledgers are used, the same effect can be obtained by reserving one page, to be used as a Sub-Total page, for about each thirty ledger pages.</p>									
					June				
					July				
Aug.					Aug.				
					Sept.				
					Oct.				
					Nov.				
					Dec.				





## THE CONTROL SHEET

### METHOD OF USE

Enter the ledger balance for the previous month on its Control Sheet.

When posting, drop Debit and Credit Markers in the ledger so that they project from the bottom and mark the ledger page of each entry.

Enter on the Control Sheet under the respective headings, namely, Sales, Journal, Voucher Record, Cash, Credit Memorandum, etc., the amounts of the original items posted from each of these sources. Then, prove the postings, i. e., add the Debit and Credit postings where indicated by the markers and enter the total of each on the Daily Control Sheet.

Cross-add the total of postings from the Sales, Journal, Voucher columns, etc., and prove against the total obtained by the direct adding of the postings in the ledger.

#### To Determine Ledger Balance:

(Referring to the Form)

Add the "Total Credits" column = \$7266.93.

Then add the "Total Debits" column = \$9933.41.

With the amount of the Debit Postings, \$9933.41, in the register, subtract out the amount of the Credit Postings. This gives the **Balance** of the postings for the month, namely, \$2666.48, which is entered on the Control Sheet.

Add to this balance, which is still in the register, the amount of the previous month's balance, \$16796.34. The result is the **Ledger Balance** for the current month, \$19462.82.

#### If Several Ledgers are Used:

Take another Daily Control Sheet for the Summary of all the ledgers. This should show the total of the Sales Postings, Journal Postings, etc., that have been made in all the ledgers combined.

Therefore, add the postings from each source as found on the several Ledger Control Sheets, and enter these totals in their respective columns on the Summary.

This method enables the Head Accountant to produce a balanced statement of any or all ledgers for any day of the month almost on a minute's notice.



### INVENTORY SHEETS—Continued

Another Inventory Sheet, and one that is coming into very general use among Department Stores, is that showing both the Cost and Selling extensions, with and without the perforated Audit Strip.

Department Stores are particularly in favor of this method of figuring Inventories. Owing to the reductions made in "Special Sales," and to frequent "Mark-Downs" in prices, it is advantageous to have the Inventories figured on both the basis of Cost and Selling Price.

The Comptometer becomes almost an actual necessity; otherwise, the cost of the Inventory is excessive and the accuracy questionable.

Before the introduction of the Comptometer, with the **Fixed Decimal Method**, the separate extensions were absolutely necessary, but at the cost of a great deal of time and energy.

#### ACCUMULATING SEVERAL ITEMS IN ONE TOTAL

The Comptometer makes possible the most efficient method—that of registering the accumulated total of a number of extensions. The operator does not concern himself with the addition, but simply makes the extensions, one after the other, and the accumulated total is his final result.

One correct total for a number of extensions, whether it be one third, one half or a full sheet, serves the same purpose obtained by extending each item by itself and writing down each one of the individual results and then adding them.

#### METHOD 2—ACCUMULATING

**Extend over the Fixed Decimal** the items covering about one third, one half, or a full inventory sheet, and enter the **total** of these results.

Prove the extensions by re-figuring the same items over the Fixed Decimal, accumulating to the previous result. This will prove beyond question, as it is impossible to make a compensating error.

See a comparison on following page of working up an Inventory by the two methods.

INVENTORY										191__ Sheet No. 167	
Called by _____			Priced by _____			Audit Extended by _____					
Entered by _____			Examined by _____								
Stock No.	Description	Quantity	Unit	Cost	Unit	Selling	Unit	Cost Ext'n	Selling Ext'n	Cost Ext'n	Sell'g Ext'n
1673	Shirt Waists	16	pieces	7.30	doz	1.48	ea				
1784	"	7	"	11.40	"	2.75	ea				
	Appl. Sump	1 5/8	doz	4.60	doz	60	"				
	"	3 1/6	"	3.85	"	50	"				
	Star	5 1/2	"	3.65	"	40	"				
	5 Poles	64									
	63	63									
	62	62									
	61	61									
	317	317	yd	8.14		134.94		84.88	140.96	84.88	140.96
										<b>ACCUMULATED TOTALS</b>	

**ECONOMY BY ACCUMULATING METHOD**

The benefits of this method over the old way of single item extension on a 40-item 1000-sheet Audit Strip Inventory are very clearly shown in the following:

**IF FIGURED ON COST PRICE ONLY****Single Extension requires—**

290,000 figures to be written,  
82,000 machine cancellations,  
80,000 items to be added.

**Accumulating by one-third of page requires—**

Only 31,000 figures to be written,  
Only 8,000 machine cancellations,  
Only 6,000 items to be added.

**Thus, the accumulating by one-third pages, or three results to a page—**

saves making 259,000 figures,  
saves making 74,000 machine cancellations,  
saves adding 74,000 items.

**IF FIGURED ON BOTH COST AND SELLING PRICES**

While, if figured on basis of both Cost and Selling Price,

**the accumulating method saves—**

Making 418,000 figures,  
Making 148,000 machine cancellations  
Adding 148,000 items.

Whether or not the Accumulating Method is used, the Comptometer offers the most efficient and accurate method of figuring and proving inventories.

**COMPTOMETER DISCLOSED A STOCK SHORTAGE**

A Piano House in St. Louis, Mo., had been accustomed to having the clerks and salesmen write up and figure the inventories.

The first time they figured it with the Comptometer it appeared to be over \$10,000.00 short. A refiguring proved the extensions and totals were all correct.

This led to an investigation and uncovering of thievery that had been practiced by one of the salesmen for several years. Owing to his assisting in taking and figuring previous inventories, he had been able to cover his stealings, which had been done by means of selling pianos and collecting personally. Comptometers have since figured all inventories in this House.

**COMPTOMETER DETECTION OF ERRORS**

A Wholesale Grocery House in Omaha, Neb., had figured and checked their inventory, when they employed a Comptometer to re-figure and prove, with the understanding that, if errors were found amounting to one-half the price of the machine, they would buy a Comptometer.

A total of \$1,565.37 in errors was found. The net of the inventory was changed \$1,156.56. They have since bought three Comptometers.

Two branches of a large Iron and Steel Company inventoried \$99,492.03.

When refigured by Comptometers,	
a total of	\$19,658.03 over-errors were found
When refigured by Comptometers,	
a total of	\$13,659.53 under-errors were found
A Net of.....	\$ 5,998.50 over-errors

Comptometers will, hereafter, figure, total and prove their inventories.

## THE PAYROLL

The Payroll and Labor Analysis occupies a very important place in connection with the Cost Work.

Payrolls of every nature afford a splendid opportunity for the Comptometer to demonstrate an accuracy that is gratifying and an economy on time and mental effort that must be appreciated by the "man to whom results count."

The principal phases of Payroll Work are:

**Day Rate**

**Weekly Rate**

**Monthly Rate**

**Hour Rate**

By the hour and minute daily

By tenths, i. e., in multiples of 6 minutes

By the hour to quarter-hours

**Piece Work**

By the piece

By the yard

By the pound and ounce

By the dozen

By the gross

By the hundred

By the thousand, etc.

**Premium and Bonus Systems of Various Natures**

The Principal uses of the Comptometer on Payroll Work are:

**Cross-Adding the Hours**

**Adding the Hours from Clock Cards**

**Adding and Deducting for Lapsed "Job Time"**

**Adding the Hours Time of the Several Workmen on each Job**

**Adding the Items of Labor Cost for the Day on each Job from the Several Operating Tickets**

**Adding the Several Items of Material Costs for the Day**

**Extending Time by Rate**

**Subtracting "Out" Deductions**

**Adding and Balancing the Payroll**

**Making up Denomination Sheets and Proving every step**

### DAY RATES

The following illustration is the most simple kind of Day Work. The majority of the amounts are known and few extensions are required.

DAY RATE PAYROLL— $\frac{1}{2}$  DAY MINIMUM

NAME	S	M	T	W	T	F	S	TOTAL	RATE	WAGE	DEDUCTIONS	PAYROLL
<i>Anna Young</i>		1	1	1	$\frac{1}{2}$	1	1	$5\frac{1}{2}$	2 50	13 75	2 00	11 75
<i>John Clark</i>		1	1	1	1	1	1	6	2 25	13 50		13 50
<i>F. A. Coon</i>		1	$\frac{1}{2}$	1	1	$\frac{3}{4}$	1	$5\frac{1}{4}$	3 50	18 38		18 38
<i>Wm. Smith</i>		1	1	1	1	1	1	6	2 50	15 00	1 60	13 40
<i>P. Becker</i>		1	1	1	1	1		5	2 75	13 75		13 75
										74 38	4 60	70 78

### COMPTOMETER WORK

Have the Comptometer right beside the Payroll.

Multiply the Time by the Rate when the answer is not apparent.

Make any deductions and prove back.

Add the Wage, Deduction and Payroll Columns and prove by adding the amount of Total Deductions to the Payroll, which should equal the Wage Column.

Work up the Denomination Sheet with the Payroll Denominator. (See Payroll Denominator.)

### PAYROLL—OVERTIME

Most employers allow their workmen additional time for work outside of regular hours.

In the following —

Time and  $\frac{1}{4}$  is allowed for Standard Overtime,

Time and  $\frac{1}{2}$  for Sundays.

The first operation is to determine the total number of hours for which the workman is to receive pay (equivalent in straight time).

#### EXAMPLE:

Regular rate,  $16\frac{1}{2}c$  per hour,

Straight Time,  $36\frac{1}{2}$  hours,

Overtime,  $9\frac{3}{4}$  hours,

Sunday time,  $22\frac{1}{4}$  hours.

### METHOD

Use the Fixed Decimal.

Add in the Straight Time..... 36.5 Hrs.

Accumulate the Overtime, ( $1\frac{1}{4}$  &  $1\frac{1}{2}$ )

by the respective hours.....

i. e.,  $9.75 \times 1.25$ .....

$22.25 \times 1.5$ .....

82.06 Hrs.

82.06 Hrs. @  $16\frac{1}{2}c$  equals..... \$13.54

With the 10 or 12-column Comptometer, leave the hours in the machine and multiply from the left. "Three Factor Method," (see index.)

## DECIMAL EQUIVALENTS

For Fractions of 8 and 9 Hour Days For Use with the Comptometer			
1	8	1	9
$\frac{1}{4}$	.125	$\frac{1}{4}$	.1111
$\frac{1}{2}$	.156	$\frac{1}{2}$	.139
$\frac{3}{4}$	.188	$\frac{3}{4}$	.167
	.219		.194
2	.25	2	.222
$\frac{1}{4}$	.281	$\frac{1}{4}$	.25
$\frac{1}{2}$	.313	$\frac{1}{2}$	.278
$\frac{3}{4}$	.344	$\frac{3}{4}$	.306
3	.375	3	.333
$\frac{1}{4}$	.406	$\frac{1}{4}$	.361
$\frac{1}{2}$	.438	$\frac{1}{2}$	.389
$\frac{3}{4}$	.469	$\frac{3}{4}$	.417
4	.5	4	.444
$\frac{1}{4}$	.531	$\frac{1}{4}$	.472
$\frac{1}{2}$	.563	$\frac{1}{2}$	.5
$\frac{3}{4}$	.594	$\frac{3}{4}$	.528
5	.625	5	.556
$\frac{1}{4}$	.656	$\frac{1}{4}$	.583
$\frac{1}{2}$	.688	$\frac{1}{2}$	.611
$\frac{3}{4}$	.719	$\frac{3}{4}$	.639
6	.75	6	.667
$\frac{1}{4}$	.781	$\frac{1}{4}$	.694
$\frac{1}{2}$	.813	$\frac{1}{2}$	.722
$\frac{3}{4}$	.844	$\frac{3}{4}$	.75
7	.875	7	.778
$\frac{1}{4}$	.906	$\frac{1}{4}$	.806
$\frac{1}{2}$	.938	$\frac{1}{2}$	.833
$\frac{3}{4}$	.969	$\frac{3}{4}$	.861
8		8	.889
		$\frac{1}{4}$	.917
		$\frac{1}{2}$	.944
		$\frac{3}{4}$	.972

## DAY RATE TO QUARTER-HOUR

Many Payrolls are Day Rates, but pay to the  $\frac{1}{4}$  Hour.  
 Example of Day Rate, 9-Hour Day,  $\frac{1}{4}$  Hour Minimum;  
 Time and One-Quarter for Over-Time.

Comptometer uses in this Payroll are:

Cross-Adding Time,  
 Totaling,

Extending Time by Rate,  
 Getting Money Denominations.

NAME	S	M	T	W	T	F	S	TOTAL	RATE	WAGE	DEDUCTIONS	PAYROLL
Wm Mead		9	9	9 $\frac{1}{4}$	11	9	9 <sup>(+)</sup>	57 $\frac{1}{2}$	2.50	15.97		15.97
A.B. Bray		9	8 $\frac{1}{4}$	9	9	7	9	51 $\frac{1}{2}$	3.00	17.17	1.75	15.42
J. Kley		9	9	9	9	9	9	54	3.42	20.52	2.50	18.02
A. F. Bouch		9	9	X	9	9	X	36	3.42	13.68		13.68
W. Long		6 $\frac{1}{2}$	7	9	9	X	9	40 $\frac{1}{2}$	2.25	10.13		10.13
										77.47	4.25	73.22

## METHOD

With the Comptometer right beside the Payroll, cross-add the Total Hours.  
 Convert any Over-Time into equivalent of Straight Time.

## OVERTIME:

Mead has 2  $\frac{3}{4}$  Hours at 1  $\frac{1}{4}$  Time.

Use the Fixed Decimal. Take Key position on the Hours,  
 (2.75) and multiply by 1.25 equals 3.4375  
 or 3  $\frac{1}{2}$  Hrs.

Plus 54 equals Total Time..... 57  $\frac{1}{2}$  Hrs.

Use the accompanying Table of Decimal Equivalents for the fractions of a day.  
 The full days and remaining hours are seen at a glance.

Multiply the Rates by the full days and the decimals for the odd hours from the Table. Hold the Rates, i. e.,  
 Multiply \$2.50 by 6.389 equals ..... \$15.97  
 Multiply \$3.00 by 5.722 equals ..... 17.17  
 Deduct from the latter \$1.75 equals ..... 15.42

This type of Payroll can be as easily expressed in days and remaining hours, i. e.—  
 57  $\frac{1}{2}$  hours as 6..... 3  $\frac{1}{2}$  51  $\frac{1}{2}$  hours as 5..... 6  $\frac{1}{2}$

### HOUR BASIS WITH A ONE MINUTE MINIMUM

This type of Payroll has been adopted by some Railroads and is found largely in the Division Superintendent's Office. Each workman's time is on a separate time slip and figured daily.

**EXAMPLE:**

9 hrs. 17 min. @ 59c  
 10 hrs. 38 min. @ 59c  
 11 hrs. 11 min. @ 48c  
 6 hrs. 41 min. @ 48c  
 7 hrs. 53 min. @ 35c

#### DECIMAL PARTS OF AN HOUR

1 Min.=.02	16 Min.=.27	31 Min.=.52	46 Min.=.77
2 " =.03	17 " =.28	32 " =.53	47 " =.78
3 " =.05	18 " =.30	33 " =.55	48 " =.80
4 " =.07	19 " =.32	34 " =.57	49 " =.82
5 " =.08	20 " =.33	35 " =.58	50 " =.83
6 " =.10	21 " =.35	36 " =.60	51 " =.85
7 " =.12	22 " =.37	37 " =.62	52 " =.87
8 " =.13	23 " =.38	38 " =.63	53 " =.88
9 " =.15	24 " =.40	39 " =.65	54 " =.90
10 " =.17	25 " =.42	40 " =.67	55 " =.92
11 " =.18	26 " =.43	41 " =.68	56 " =.93
12 " =.20	27 " =.45	42 " =.70	57 " =.95
13 " =.22	28 " =.47	43 " =.72	58 " =.97
14 " =.23	29 " =.48	44 " =.73	59 " =.98
15 " =.25	30 " =.50	45 " =.75	60 " =1.00

Hold the Rate for the Key Position and multiply by the hours and the decimal, as expressed in the accompanying table.

#### Use the Fixed Decimal.

$$.59 \times 9.28 = 5.48$$

$$.59 \times 10.63 = 6.27$$

$$.48 \times 11.18 = 5.37$$

$$.48 \times 6.68 = 3.20$$

$$.35 \times 7.88 = 2.76$$

Where the Comptometer is used on this type of Payroll, errors are practically eliminated and the time of the figuring cut in half.

### PAYROLL WITH SIX MINUTE MINIMUM

Many Payrolls are being figured on a six minute minimum basis, which allows the time to be entirely expressed in hours and decimals of an hour, i. e.,—

9 hours and 24 minutes as 9.4

7 " " 48 " " 7.8

3 " " 18 " " 3.3 Etc.



### PAYING BY THE WEEK ON A 48 HOUR BASIS

The following Table shows the Decimals of a Week by Quarter-Hours up to the full week. This 48 Hour Week is prevalent among Publishing Houses.

You can adopt this plan for Payrolls on a weekly basis with any number of hours constituting a full week. Make up a similar Table when the number of hours constituting a full week differ.

EXAMPLE:

$$\begin{array}{rcl}
 45\frac{1}{4} \text{ Hours @ } \$26.00 & = & \$24.51 \\
 42\frac{1}{2} \text{ " @ } 18.00 & = & 15.94 \\
 44 \text{ " @ } 26.00 & = & 23.91 \\
 44 \text{ " Str. Time} & & \\
 8\frac{1}{2} \text{ " } 1\frac{1}{4} \text{ " } & & \\
 16 \text{ " } 1\frac{1}{2} \text{ " } & & \\
 @ \$22.50 & & \\
 \hline
 & = & \$36.80
 \end{array}$$

#### METHOD

Use the Fixed Decimal.

Take Key Position on Rate per Week, i. e., \$26.00.

Looking at the Table, you see  $45\frac{1}{4}$  hours is .9426 of a week. Therefore, move to the right one place and multiply in the regular manner .9426.

Continue in like manner for other extensions.

#### The Overtime:

First convert into equivalent of Straight Time, i. e.,—

Use the Fixed Decimal and accumulate.

Add in the Straight Time..... 44 Hrs.

Hold the hours for Time and  $\frac{1}{4}$  and multiply 1.25.....

Hold the hours for Time and  $\frac{1}{2}$  and multiply 1.5.....

Equals a Total of..... 78.625

which is treated as  $78\frac{1}{2}$  hours, or one week and  $30\frac{1}{2}$  hours.

Clear the machine. Hold the Rate 22.50 and multiply by 1.6354 equals \$36.80.

FRACTIONAL PARTS OF A WEEK				
of				
48 Hours,				
	$\frac{1}{4}$	$\frac{1}{2}$	$\frac{3}{4}$	$\frac{1}{1}$
1	.0208	.0260	.0315	.0365
2	.0417	.0469	.0521	.0573
3	.0625	.0677	.0729	.0781
4	.0833	.0885	.0937	.0990
5	.1042	.1094	.1146	.1198
6	.1250	.1303	.1354	.1406
7	.1458	.1510	.1562	.1614
8	.1666	.1719	.1771	.1823
9	.1875	.1927	.1979	.2031
10	.2083	.2135	.2187	.2239
11	.2292	.2344	.2396	.2448
12	.25	.2552	.2604	.2656
13	.2708	.2760	.2812	.2864
14	.2916	.2969	.3021	.3073
15	.3125	.3177	.3229	.3281
16	.3333	.3385	.3437	.3489
17	.3541	.3594	.3646	.3698
18	.3750	.3802	.3854	.3906
19	.3958	.4010	.4062	.4114
20	.4166	.4218	.4271	.4323
21	.4375	.4427	.4479	.4531
22	.4583	.4635	.4687	.4739
23	.4791	.4843	.4896	.4948
24	.5	.5052	.5104	.5156
25	.5208	.5260	.5312	.5364
26	.5416	.5468	.5520	.5573
27	.5625	.5677	.5729	.5781
28	.5833	.5885	.5937	.5989
29	.6041	.6093	.6145	.6198
30	.6250	.6302	.6354	.6406
31	.6458	.6510	.6562	.6614
32	.6667	.6718	.6770	.6822
33	.6875	.6927	.6979	.7031
34	.7083	.7135	.7187	.7239
35	.7291	.7343	.7395	.7447
36	.75	.7552	.7604	.7656
37	.7708	.7760	.7812	.7864
38	.7916	.7968	.8020	.8073
39	.8125	.8177	.8229	.8281
40	.8333	.8385	.8437	.8489
41	.8541	.8593	.8645	.8697
42	.8749	.8802	.8854	.8906
43	.8958	.9010	.9062	.9114
44	.9196	.9218	.9270	.9322
45	.9374	.9426	.9479	.9531
46	.9583	.9635	.9687	.9739
47	.9791	.9843	.9895	.9947
48	1.0000			
$\frac{1}{4}$ .0052 $\frac{1}{2}$ .0104 $\frac{3}{4}$ .0156				

# **PAYROLL TABLE FOR RAILROAD DIVISION SUPERINTENDENT'S OFFICES**

The pay is by the month. The month may be 28, 29, 30 or 31 days, the smallest division of pay being for one-half day.

TABLE SHOWING DECIMALS OF A MONTH BY DAYS. 1/4, 1/2, and 3/4 of a Day.							
26 Day.	27 Day.	28 Day.	29 Day.	30 Day.	31 Day.		
1 .0385	.0370	1 .0387	.0383	1 .0323	.0323		
2 .0769	.0741	2 .0714	.0667	2 .0645	.0645		
3 .1153	.1111	3 .1071	.1000	3 .0968	.0968		
4 .1538	.1481	4 .1429	.1333	4 .1290	.1290		
5 .1923	.1852	5 .1786	.1667	5 .1613	.1613		
6 .2308	.2222	6 .2143	.2000	6 .1955	.1955		
7 .2692	.2593	7 .2500	.2333	7 .2258	.2258		
8 .3077	.2963	8 .2857	.2667	8 .2581	.2581		
9 .3462	.3333	9 .3214	.3000	9 .2903	.2903		
10 .3846	.3704	10 .3571	.3333	10 .3226	.3226		
11 .4231	.4074	11 .3929	.3667	11 .3549	.3549		
12 .4615	.4444	12 .4286	.4000	12 .3871	.3871		
13 .5000	.4815	13 .4643	.4333	13 .4194	.4194		
14 .5385	.5185	14 .5000	.4667	14 .4516	.4516		
15 .5769	.5556	15 .5557	.5000	15 .4839	.4839		
16 .6154	.5926	16 .5714	.5333	16 .5161	.5161		
17 .6538	.6296	17 .6071	.5667	17 .5484	.5484		
18 .6923	.6667	18 .6429	.6000	18 .5806	.5806		
19 .7308	.7037	19 .6786	.6333	19 .6129	.6129		
20 .7692	.7407	20 .7143	.6667	20 .6452	.6452		
21 .8077	.7778	21 .7500	.7000	21 .6775	.6775		
22 .8462	.8148	22 .7857	.7333	22 .7097	.7097		
23 .8846	.8519	23 .8214	.7667	23 .7419	.7419		
24 .9231	.8889	24 .8571	.8000	24 .7742	.7742		
25 .9615	.9259	25 .8929	.8333	25 .8065	.8065		
26 .9630	.9630	26 .9286	.8667	26 .8387	.8387		
27		27 .9643	.9000	27 .8710	.8710		
28			.9333	28 .9032	.9032		
29			.9667	29 .9355	.9355		
30				30 .9677	.9677		
1/4 Day. .0096	.0093	1/4 Day. .0089	.0085	1/4 Day. .0081	.0081		
1/2 Day. .0192	.0186	1/2 Day. .0179	.0167	1/2 Day. .0161	.0161		
3/4 Day. .0288	.0278	3/4 Day. .0268	.0250	3/4 Day. .0242	.0242		

## **31-day Month.**

EXAMPLE:

24 days @	.....\$78.00
26 days @	..... 78.00
28 1/2 days @	..... 95.00
35 1/4 days @	..... 90.00

## **METHOD**

Use the Fixed Decimal.

Hold the Rate for Key Position and multiply by the Decimal Equivalent of the Time, i. e.—

Multiply—

$$78 \times .7742 \text{ (Decimal for 24)} \dots\dots \$60.39$$

$$78 \times .8388 \text{ (Decimal for 26)} \dots\dots 65.43$$

When fractions of days occur, a good plan is—

Hold the Rate.

Multiply by the Decimal Equivalent for the full days, and fraction of a day—

$$95 \times .9033$$

$$\times .0162$$

(The last multiplying position in the above was for the 4th decimal; therefore, hold the position and multiply by the 4th decimal for the fraction of a day, .0162, toward the left.)

$$95 \times .9194 \text{ (Decimal for } 28\frac{1}{2}) \dots\dots \$87.35$$

$$90.00 \times 1.1613 \text{ (Decimal for } \dots\dots ) \dots\dots$$

$$\times .0081 \text{ (1 Mo. \& } 5\frac{1}{4} \text{ days)} \dots\dots 105.25$$

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$$\$318.42$$

## HANDLING THE PAY ROLL CARD

Form T-510 0000-12 07-00		
No. <u>425</u>		
<b>THIS SIDE OUT</b>		
<b>PAY ROLL CARD</b>		
Pay Ending <u>Dec 15</u>		
Name <u>A. McVick</u>		
Day <u>TH</u> Date <u>Dec 7</u>		
Morning	In	8:58
Morning	Out	12:08
Afternoon	In	12:39
Afternoon	Out	16:23
Overtime	In	18:30
Overtime	Out	21:24
Hours	9	S. T. 3 O. T.
Rate	26	
Amount	52.24	OT 1.17
Total Wage	351	
Forwarded		

S. O. NO. ON LOT NO.	PART NO. AND NO. PCS.	OPER. NO. AND EQUIP. NO.	ELAPSED TIME	CLOCK NO. TIME RECORD
376	36		3 1/2	OFF 10:30
			11	ON 7:00
472	14		1 1/2	OFF 10:00
			2A	ON 10:20
472			2 3/4	OFF 15:15
			1 1/2	ON 12:20
496			1 1/4	OFF 16:30
			3/2	ON 15:15
196			1 1/2	OFF 4:20
			1 1/2	ON 18:22
				OFF
				ON

S. O. NO. ON LOT NO.	PART NO. AND NO. PCS.	OPER. NO. AND EQUIP. NO.	ELAPSED TIME	CLOCK NO. TIME RECORD
				OFF
				ON

Extra Time for Overtime 3 1/2

Total Time 4-4 1/2 Clock No. 435

Rate 26 Date 12/15

Amount 351

O. K. \_\_\_\_\_ Foreman

**First Operation:**—Determine the working time thus— 12.  
Add on the Comptometer the out time, in hours and decimals of an hour, for both A.M. and P.M. . . . . 16.50

28.50

(The approximate decimal for minutes is seen at a glance)

Subtract the in time of both A.M. and P.M., viz., 7 & 12.50 . . . . . 19.50

The difference is the lapsed time . . . . . 9.00 hrs.

## EXTENDING THE TIME

**Second Operation:**—Extend the Straight Time on the Right Side of Comptometer . . . 2.34

The Over Time on the Left Side, at time and a half . . . . . 1.17

Then, with both amounts in the Register, add the O. T. to the S. T. for the total day wage 3.51

The Straight Time and the Over Time are figured separately, in order to obtain the total amount paid out for Over Time.

**Third Operation:**—(One workman may be employed on several jobs during the day.)

Extend the time on the Operation Card. Add the several extensions and balance against the Pay Roll Card.

(The Pay Roll Cards are then posted to the P. R. Ledger).

The next operation is **segregating Job Costs** in each department for determining the total hours and wage against the various jobs.

The Operation Card is now cut up and these small Operating Tickets are segregated according to the jobs, perhaps from 3 to 20 tickets for a job.

The Comptometer then adds, with the **one handling** of the Operation Tickets, the **hours on the left** and the **money on the right** side of the keyboard.

### **PAYROLL CARD—Continued**

Then the foregoing are charged to the various Cost Cards, the total of which will balance against the Payroll Ledger, which now contains the data from the P. R. Cards.

Therefore—add directly on the Comptometer the hours and money as posted to the Cost Cards and prove with the P. R. Ledger.

### **ACCURACY**

Accuracy is always the paramount issue in the Payroll as well as other Cost work, the results of one operation should be made to prove against another as far as possible.

### **COMPTOMETER EFFICIENCY**

The Comptometer actually reduces the cost of securing this data from 25 to 75%—

In other words it enables a Commercial House or Manufacturer to obtain intelligent and comprehensible data of manufacturing and selling costs at comparatively little outlay.

The methods employed in Payroll and Cost work vary so greatly that the salesman should see the necessity for making a close analysis of same in each individual office, with a view of eliminating all waste in the operations required for securing the desired data.

*Figuring Time Slips on Comptometer in a Large Manufacturing Establishment*

## COMPTOMETER WITH COIN AND CURRENCY DENOMINATOR

The combination of the Comptometer and Payroll Denominator enables the Timekeeper to determine the number of coins and currency of each denomination required for the Payroll in a few minutes with positive proof of accuracy.

The Denominator is placed on the Comptometer Keyboard, as shown in the illustration, and serves to separate the columns set apart for each denomination.

First find the number of coins required of each denomination.

### METHOD

Place the Denominator in position.

The first coin item in the Payroll is \$.97.

	50c	25c	10c	5c	1c
	<u>1</u>	<u>1</u>	<u>2</u>	<u>—</u>	<u>2</u>
97c contains . . . . .					
	<b>Payroll</b>				
	\$16.97				
	14.68				
	26.44				
	13.29				
	8.76				
	<u>9.63</u>				
	<b>\$89.77</b>				

Add where designated by the Denominator, the number of Halves, Quarters, Dimes, Nickels and Pennies, continuing to the total for each Payroll sheet.

Coins	Currency	
17— 1c	—	\$ .17
2— 5c	—	.10
5—10c	—	.50
4—25c	—	1.00
4—50c	—	2.00
	4—\$1.	4.00
	6— 2.	12.00
	4— 5.	20.00
	3—10.	30.00
	1—20.	<u>20.00</u>
		<b>\$89.77</b>

After determining the coins for a sheet, or section, of the Payroll, find the number of bills in the same manner.

## CLOCK AND TIME CARDS

## PAYROLL—HOUR RATES

The following details the Payroll operations in a large manufacturing plant. In a general way, it is suggestive of the Payroll routine in factories employing the Clock Card System.

The Payroll is made up every two weeks. One Clock Card provides for the entire time. Overtime is converted into straight time at time and a half.

One "Labor Time Card" is filled out and turned in each day by each employee.

**A. B. Motor Company**  
**PAY CHECK**

No. 275-A

PAY ENDING.....  
RECEIVED PAYMENT.....  
*John Smith*

Form No. 434  
PAY ENDING Feb. 14<sup>th</sup> 1913

No. 275-A  
NAME John Smith

Q	MOORING IN	MOORING OUT	MOORING IN	MOORING OUT	EXTRA IN	EXTRA OUT	Q
	1-6 55	11 31	11 55	4 32			9
/	6-6 51	11 31	11 56			5 31	9
/	4-6 50	11 32	11 57	4 30	4 59	6 00	9
	5-7 01	11 31	11 56	4 35			9
	8-8 45	11 32	11 46	3 35			8
4 1/2	7-8 50	11 35	11 56			8 45	9 1/2
	8-8 55	11 35	11 55	3 45			8 1/2
	9-8 50	11 55					3
	10-8 45	11 31	11 59	4 31			9 1/2
	11-6 45	11 30					4 1/2
/	12-6 51	11 31	11 59	4 32	5 16	6 10	9
13							
	14-8 55	11 31	12 01	4 35			9
TOTAL TIME..... <u>107 1/2</u> ..... HR							
RATE..... <u>24</u> .....							
TOTAL WAGES..... <u>2579.50</u> .....							

(Continued.)

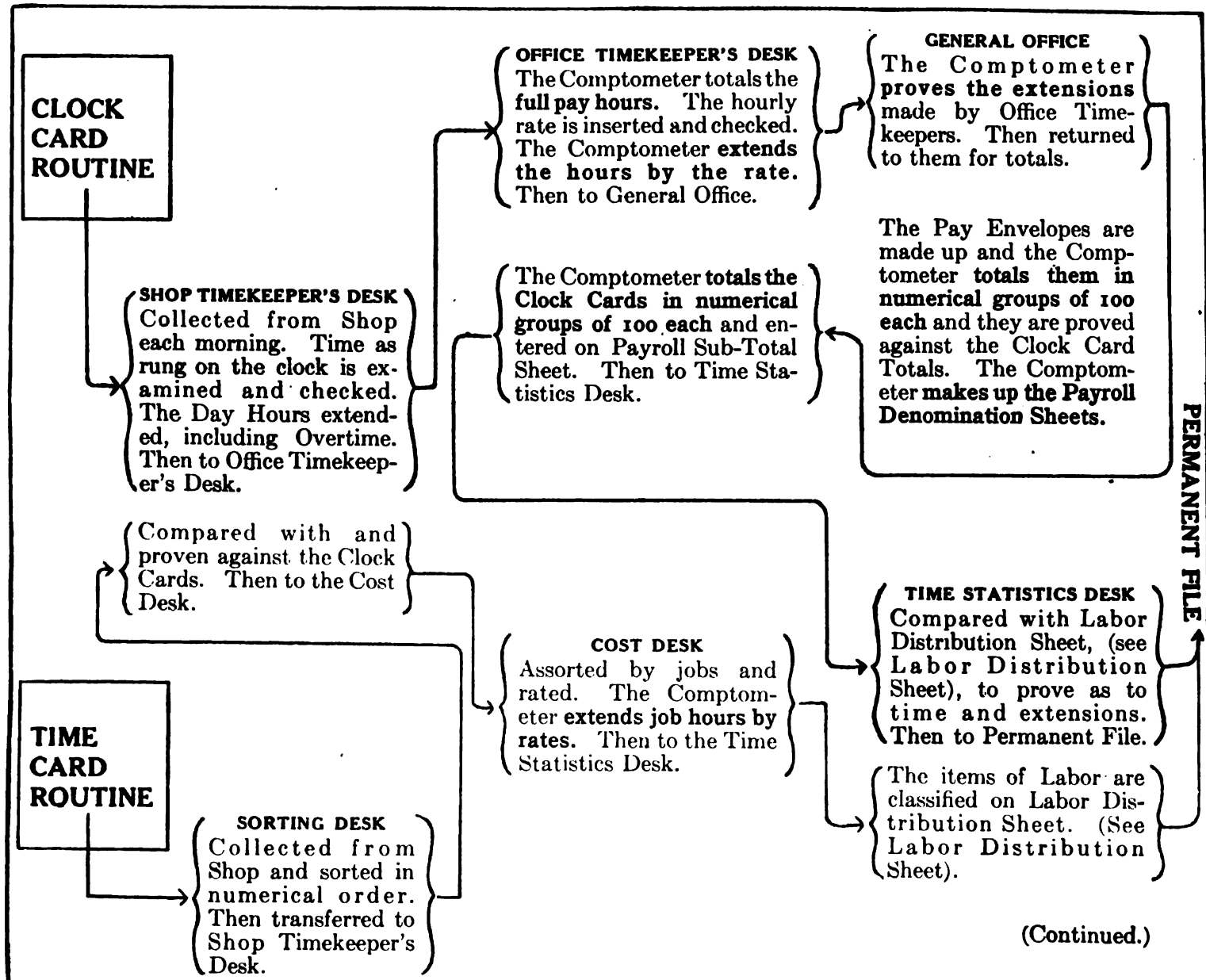
Dept. K. 1-16  
**A. B. Motor Co**  
**TIME TICKET**  
MANUFACTURING DEPT.

Empl. Name Partel

Date..... 191..... Empl. No. 22653

Prod. Order Number	PART No.	Operat's No.	Operation	DESCRIPTION	Time Picked	HOURS
			Snag			
57734619			Drill			
			Room			
			Bore			
			Turn		60	4 1/2
			Face			
			Mill			
			Tap			
			Broach			
			Thread		85	3 1/2
			Punch			
			Center			
			Press			
			Grind		100	10 1/2
			Cut Teeth			
O. K. <u>Schwartz</u> Total					18 1/2	

## CLOCK AND TIME CARD ROUTINE



## LABOR DISTRIBUTION SHEET

## AT THE "TIME STATISTICS" DESK

Each workman's time is entered on the Labor Distribution Sheet direct from the Time Cards. Each Department or class of work is charged with the actual hours.

LABOR DISTRIBUTION SHEET TWO WEEKS ENDING <u>Feb. 14 1913</u>																				
EMPLOYEES NAME AND NO	ACCOUNT NO	S.														TOTAL HOURS	RATE	ITEMS	AMOUNT EARNED	MEMO OF PAID OFFS
		1	2	3	4	5	6	7	8	9	10	11	12	13	14					
A 275 J. Nelson	Med. H.	4			5		4	7		5		9			36	26	910	2730		
	Trade	3		5	4		2		4					8	26		690			
	Med. X	2		4		8		7		3		4			30		787			
	Rep			1			2		4		4		1		13		338			

## PAYROLL AND RECAP. LABOR DISTRIBUTION

A-1' 2000 Date				
100	1276	55		2100
200	1973	40		2200
300	2743	55		2300
400	864	30		2400
500	1735	45		2500

1900	2745	55		3900
2000				4000
Total	34347	55		

At the end of the Pay Period, the Comptometer cross-foots these hours and extends each class at the rate per hour.

The total of these several extensions for each workman proves against the total on his Clock Card.

For convenience of proving the Labor Distribution Sheets, a Recapitulation of Classified Labor is made from the Payroll for each 100 workmen.

The Clock Cards are totaled in corresponding numerical groups, in order to facilitate proving the Labor Distribution. These totals, in groups of 100 Payroll numbers, are entered from the Comptometer direct to the Payroll Sub-Total Sheet.

The adding of this Sub-Total Sheet gives the total Payroll and proves against the corresponding totals which have been made of the pay envelopes.

The Comptometer is the medium for producing every figure result in the most efficient and accurate manner possible.



## PIECE WORK PAY ROLL

The following is a sample of Pay Roll work that was **figured** and **proven** on the Comptometer in less than one-third the time previously required.

### WOODWORKING

250 pieces @	30c per hundred
145 " "	40c
650 " "	6c
467 " "	35c
52 " "	\$1.25
48 " "	90c
1430 " "	60c
250 " "	60c
142 " "	45c
50 " "	25c
Total Wage . . .	\$15.28

This is unusually easy for piece work, the prices having been equalized as much as possible, with a view to making easy mental figuring.

The old way necessitated writing the result of each extension and then adding for total wage.

### METHOD "A"

Hold the price for multiplier keys on the Right of Key Board; accumulate and point off four decimal places.

### METHOD "B"

The better plan is—

To hold the **quantity** for multiplier keys.

Basis for key position should be the **unit** figure of the quantity and the column corresponding to the price figure to be multiplied.

Multiply toward the left; point off four decimal places, as before.

e.g.—

250 @	30c	Key position with the 0 (250) in the 30c column
145 @	40c	Key position with the 5 (145) in the 40c column
650 @	6c	Key position with the 0 (650) in the 6c column
467 @	35c	Key position with the 7 (467) in the 5c column
52 @	\$1.25	Key position with the 2 ( 52) in the 5c column

### ADVANTAGES

It lessens the number of key strokes;

Takes the first keys in the actual multiplying position.

## PREMIUM PAY ROLL

A standard of production is determined.

The workman who produces more than the standard receives pay for the over-production in addition to his hourly rate. This is usually  $33\frac{1}{3}$  or 50%.

### METHOD

Allow 1,000 points per hour as a standard of production, i. e., if a man works nine hours 9,000 points would be allowed for his regular day's work and any over that would be the basis for the amount of premium.

1st. The standard time for each job is ascertained. It may be five minutes or five hours and from this is established the points to be allowed per unit or per piece of work turned out, thus:

2d. A good workman turns out 333 table legs in 9 hours, allowing 1,000 points per hour or 9,000 per 9 hour day for the standard production, the points per unit or per table leg will be 9,000 divided by 333 or 27 points per table leg or unit.

3d. The number of units actually turned out times the points per unit equals the **total points** for the work.

4th. The **total points** less the Standard Points for the time worked (hrs. worked times 1,000) equals the over-production.

5th. The workman's percentage of over-production (say 50%) is added to the Standard Points and equals the total for which he receives pay.

The advantages of paying on this order are:

1st. The incentive to the workman who is guaranteed his regular day's wage, and receives a benefit from his better efforts resulting in increased production.

2d. The lessened cost to the Employer whose manufacturing cost is reduced as the Workman's efficiency and pay increases, and who also benefits by the decreased Burden Cost per unit of Production.

## PREMIUM. PAY ROLL

Basis 1<sup>st</sup> ESTABLISHED PRODUCTION For A DAYS WORK (8-9 or 10 HRS)  
 2<sup>nd</sup> WORKMEN TO RECEIVE A % For OVER-PRODUCTION

Example— STANDARD DAY- 9 HRS  
 FIXED POINTS PER HOUR - 1000  
POINTS FOR STANDARD DAY - 9000

TO DETERMINE POINTS PER UNIT—JOB<sup>no</sup> 221  
 NORMAL PRODUCTION IS 333 PIECES  
 IN 9 HRS — THEREFORE = 9000 POINTS.  
 THEN 1 UNIT (or PIECE) =  $\frac{9000}{333}$  = 27 POINTS  
 PREMIUM 50% IN THIS FACTORY.

JOB No	PIECES	POINTS <sup>EA</sup>	HOURS	POINTS	
221	176	27	2 $\frac{1}{4}$		
44	86	34	3		
167	38	22	1 $\frac{1}{2}$		
12	134	18	1 $\frac{1}{4}$		
5	22	9	1		
RATE 27* Per Hr		TOTAL	9	11122	
			OVER	2122	
AMOUNT \$2.72		50% PREMIUM	1061		
		TOTAL NET POINTS	10061		\$2.72

### COMPTOMETER METHOD

ADD THE HOURS = 9 HRS  
 ACCUMULATE PIECES BY  
 POINTS EACH = 11122  
 DEDUCT POINTS FOR  
 STANDARD DAY =  $\frac{9000}{2122}$   
 GET 50% OF RESULT = 1061  
 ADD BACK POINTS FOR  
 STANDARD DAY = 10061  
 MULTIPLY BY RATE PER HR. = \$2.72

## TWO METHODS OF WORKING UP A FOUNDRY PIECE PAY ROLL

## THE OLD WAY

S. K. SMITH COMPANY					
					Date <u>Dec 10</u>
FOUNDRY WORK TICKET					
Job No.	Desc. of Work	No. Pcs.	Rate	Amount	Ck.
601	Catgs	135	2 1/4	3 04	✓
26		46	3	1 38	✓
296		130	4 1/4	5 53	✓
45		14	2.6	3 64	✓
62		145	3 1/8	4 53	✓
80		240	5 5/8	13 50	✓
Extended by <u>H H</u>				31	62 ✓
Checked by <u>K. H</u>					
Entered on Pay Roll <u>AB</u>					

$$\begin{array}{r} 135 \\ 24 \\ \hline 33 \\ 270 \\ \hline 304 \end{array}$$

$$\begin{array}{r} 14 \\ 26 \\ \hline 84 \\ 28 \\ \hline 364 \end{array}$$

$$\begin{array}{r} 130 \\ 44 \\ \hline 322 \\ 520 \\ \hline 552 \end{array}$$

$$\begin{array}{r} 240 \\ 58 \\ \hline 30 \\ 150 \\ \hline 1200 \\ 1350 \end{array}$$

$$\begin{array}{r} 145 \\ 38 \\ \hline 183 \\ 435 \\ \hline 453 \end{array}$$

$$\begin{array}{r} 14 \\ 26 \\ \hline 84 \\ 28 \\ \hline 364 \end{array}$$

$$\begin{array}{r} 145 \\ 38 \\ \hline 183 \\ 435 \\ \hline 453 \end{array}$$

## THE COMPTOMETER METHOD

S. K. SMITH COMPANY					
					Date <u>Dec 10</u>
FOUNDRY WORK TICKET					
Job No.	Desc. of Work	No. Pcs.	Rate	Amount	Ck.
601	Catgs	135	2 1/4		
26		46	3		
296		130	4 1/4		
45		14	2.6		
62		145	3 1/8		
80		240	5 5/8		
Extended by <u>H H</u>				31	61 ✓
Checked by <u>K. H</u>					
Entered on Pay Roll <u>AB</u>					

## NOTE THE DIFFERENCE

With the Comptometer use the Fixed Decimal Method, multiply the pieces by the rate, accumulating for the total wage due each workman. Prove in the same manner.

## PENCIL AND PAPER

Figured and checked  
in 3 minutes.

## COMPTOMETER

Figured and proven  
in 40 seconds

FIGURES MADE

## COST WORK

Cost Accounting is recognized as one of the prime factors that enables the successful manufacturer and commercial house to make a scientific study and analysis of the business.

It furnishes the means of making a comprehensive study of the relation of each feature and element in the business; therefore, supplies an invaluable aid to the policy of the management and direction that will tend to develop the business in the broadest and most successful manner.

Each feature of the business should be analyzed in such manner that the management is able to consider in detail the cost of each element, the cost of each part and group of parts, and finally the total cost of the finished article.

The value of this knowledge lies in the aid it affords in the direction of—

**Determining Selling Prices**

**Determining Economical Selling Methods**

**Determining the Cheapest and Best Manner of Producing the Various Parts**

**Determining Ideas of Change in Construction, Design, Etc.**

The value of the Comptometer lies in the economy and accuracy it effects in **producing this data.**

The problems confronting the Merchant and Jobber are much the same excepting that he is interested in a corresponding analysis of his selling, buying and carrying costs; his losses through change in demand, in style, in deterioration, decay, etc. Also in the selling power of his several salesmen; whether they have the ability to dispose of the special lines which represent the greatest profit, or to take only the easy orders, etc.

This field is seemingly as unbounded and susceptible to as many variations in the methods employed as there are business houses.

Our work is now to consider the most efficient method of handling:

Statistical Work

Productive Data

Labor Analysis, etc.

## DEPARTMENT COST

In a comprehensive Cost Study it is necessary to go beyond the mere cost of the part. A knowledge must be had of each element of cost.

Job No. 376	Article	No. of Pcs. 36		
<hr/>				
LABOR				
PRODUCTIVE	Total Cost	Cost Each	%	
Milling . . . . .	37 60	1.044	.1764	
Buffing . . . . .	8.36	.232	.0392	
Grinding . . . . .	11 40	.317	.0536	
Assembling . . . . .	29.27	.813	.1374	
Woodwork . . . . .	43 75	1.215	.2053	
	<hr/>	<hr/>	<hr/>	
	130.38	3.621	.6119	
NON-PRODUCTIVE				
Supervision . . . . .	15 00	.417	.0705	
General, etc. . . . .	12 50	.347	.0586	
	<hr/>	<hr/>	<hr/>	
	27.50	.764	.1291	
MATERIAL				
Bronze Metal Catgs. . . . .	21 38	.594	.1004	
Gray Iron Catgs. . . . .	7 46	.207	.0350	
Steel Plate . . . . .	2 50	.069	.0116	
Babbitt Metal . . . . .	3.28	.091	.0154	
Oak . . . . .	12 67	.352	.0595	
Pine . . . . .	4 70	.131	.0221	
Hardware . . . . .	3.20	.089	.0150	
	<hr/>	<hr/>	<hr/>	
	55 19	1.533	.2590	
	<hr/>	<hr/>	<hr/>	
	213 07	5.918	1.0000	

**COST WORK FIGURED MENTALLY IS SLOW  
AND LABORIOUS**

**EASY WITH THE COMPTOMETER**

Here we have the following information:—

The Labor Cost of each operation for the job,—

The Material Cost of each kind of material,—

The Per Cent of each item of cost to the whole.

The Comptometer affords an exceptionally easy and accurate manner of securing this detailed data.

**COSTS AND ESTIMATING**

The following are examples of Cost Work and Estimating on which the Comptometer has increased the efficiency 30 to 80%, doing the work in from one-quarter to three-quarters of the time previously required.

Some manufacturers desire to have the exact quantity figured and then allow a certain per cent for waste.

**EXAMPLE:**

2 pieces  $62\frac{1}{2} \times 4\frac{1}{4} \times \frac{3}{4}$ ",  
 6 "  $16\frac{1}{4} \times 4\frac{5}{8} \times \frac{3}{4}$ ,  
 4 "  $33 \times 2\frac{1}{4} \times 1$ ,  
 5 "  $22\frac{1}{4} \times 2\frac{3}{4} \times 1$ .

This work is figured in two ways.

**METHOD "A"**

Mentally multiply the number of pieces by the width or length, which ever is desired. Then multiply this result on Comptometer, using the Fixed Decimal, and accumulate for the total number of square inches for all stock of the same thickness. All pieces under 1" are reckoned as 1".

**Mentally On Comptometer with Fixed Decimal.**

e.g.,  $2 \times 4\frac{1}{4} = 8\frac{1}{2} \times 62\frac{1}{2}$   
 $6 \times 16\frac{1}{4} = 97\frac{1}{2} \times 4\frac{5}{8}$   
 $4 \times 2\frac{1}{4} = 9 \times 33$   
 $5 \times 2\frac{3}{4} = 13\frac{3}{4} \times 22\frac{1}{4}$  ———  
 Total Square in. . . . 1585  
 1585 divided by 144 = 11 Bd. Ft.

**METHOD "B"**

Some manufacturers treat each fraction of an inch as a whole inch. This allows liberally for waste and makes a more liberal margin for net profit.

The foregoing would then be figured as follows:

<b>Mentally</b>	<b>On Comptometer</b>
<b>Pieces <math>\times</math> Width</b>	<b>at Right of Keyboard</b>

$2 \times 5 =$	$10 \times 63$
$6 \times 5 =$	$30 \times 17$
$4 \times 3 =$	$12 \times 33$
$5 \times 3 =$	$15 \times 23$ ———

Total sq. in. . . . 1881  $\times .007$  (The reciprocal of 144) = 13 bd. ft.

## PAYROLL AND LABOR COST TICKETS

## PAYROLL AND LABOR COST TICKETS

Employee	John Smith	Dept. 25	
For Milling	746 pcs. #1741 @	17 1 2c per 100	\$1.31
" Buffing	1379 " #2373 "	18 3 4c " "	2 59
" Grinding	873 " # 439 "	22 1 4c " "	1.94
			<u>\$5.84</u>

(Figured on the Comptometer in 15 seconds)

Items like the above, to the number of thousands, are included in the work of many Cost departments in making up the Payroll. The Comptometer will handle them with surprising speed and accuracy.

If the Cost of Each Operation is wanted, in order that the total Labor Cost of that operation or department may be obtained:—

Extend each item separately over the Fixed Decimal and add the several amounts for total.

Prove by accumulating.

If Only the Total Wage is required:—

Extend the several items over the Fixed Decimal, accumulating to the total.

Prove in the same manner.

## MATERIAL COSTS

## REQUISITION ON STOREROOM

Dept. 17

Please furnish this department with the following

2500 pcs. Angles 1 1/2" each 2.1 lbs. per ft @	\$1.35 per Cwt.	\$8.66
7157 pcs. Tubing 1 1/16" each pc. 2'7" long @	2 36 per 100 ft.	436.34
		<u>\$445.20</u>

(Either item figured on Comptometer in 20 seconds)

Where there are a large number of requisitions from each department every month, you will readily observe what a great saving may be effected.

## METHOD

- (1.) Multiply the pieces by the length:—

$2500 \times 1.5 = 3750 \text{ in.}$   
 Reduce to feet, dividing this result  
 by 12..... 312.5 ft.  
 Leave this in the machine and  
 multiply by 2.1..... 656.25 lbs.  
 Continue and multiply by price  
 per cwt..... \$8.86

- (2.) Hold the pieces for Key Factor.  
 Use the Fixed Decimal. Split the  
 Multiplier and take first position  
 on 71. Multiply through by the  
 feet and decimal..... 2.5833

Then continue and use the balance  
 of the Multiplier—57..... 18,489 ft.  
 (The decimal of a foot being more  
 than one-half, is treated as a full  
 foot).

With the 10 or 12-column Comptometer this result can be left in the Register and multiplied by the price. ("Three Factor Work.") Otherwise, clear the machine and make a straight multiplication.  
 $18,489 \times \$2.36 \dots\dots\dots$

\$436.34



### DETERMINING THE ACTUAL AND PER CENT SAVING

A manufacturer of automobile rims, operating on a piece basis at 4c each, changed to Premium system, as follows:

Rate.....28c per Hour  
 Premium.....50% on Over Production  
 Day .....10 Hours  
 Standard.....1000 Points per Hour  
 10,000 Points.70 Rims, a Standard Day's Work  
 1 Rim Equals.143 Points

**A Workman Turns Out 82 Rims for a Day's Work.**

$82 \times 143 = 11726$  Points

or 1726 Pts.

above Standard

50% of 1726 = 863 "

Plus the Standard

Day's Pts. =  $\frac{10000}{10863}$  "

10863 Points @ 28c per thousand = \$3.04

**What is the Actual Saving per Rim?**

**What is the Per Cent of Saving per Rim?**

The old cost is .04 each .04

82 Rims cost \$3.04

1 Rim costs  $3.04 \div 82 = .0371$

Saving per Rim  $\underline{.0029}$

The Per Cent of Saving is—

$.0029 \div .04 = .0725\%$

### COMPUTATION OF PER CENT OF PRODUCTIVE LABOR OF EACH DEPARTMENT TO TOTAL PRODUCTIVE LABOR OF PLANT

Total Productive Labor of Plant . . . . . \$83,471.62  
 Productive Labor of Department No. 25 16,338.94  
 Proportion of Department No. 25 to  
 Whole . . . . . 19.57%

The division necessary to arrive at the above per cent is a difficult mental calculation. With the Comptometer you can do it in 25 seconds and prove the result in six seconds.

As there are only four figures wanted in the per cent, use first five figures of the divisor, i. e., 83,472, splitting between 834 and 72.

Prorating forms a considerable part of Cost Work. The Comptometer provides absolutely the most efficient and accurate means of prorating known.

### DEPARTMENTAL OUTPUT FOR MONTH

DEPARTMENT 14			
	Labor	Material	Indirect Labor
7187 pcs. #1248 Brass Mounts	\$3.89 per 100	\$46.75 per M	112½% of Labor
Extension . . . . .	\$279.57	\$335.99	\$314.52

(Figured on the Comptometer in 18 seconds)

#### METHOD

The better plan is to use the Fixed Decimal on all this work.

#### LABOR:

Hold 389, as Key Factor, and multiply 71.87 . . . . . \$279.57

#### MATERIAL:

Split the Multiplier and hold first 46—; then 75, and multiply 7.187 . . . . . \$335.99

#### INDIRECT LABOR:

The Indirect Labor being 112½% of the Labor, use 279.57 for Key Factor, holding first 279—, and then 57; or, first 27—and then 957, and multiply by 1.125 . . . . . \$314.52

The foregoing is a sample of work taken from the Cost Department of a large manufacturing firm. It will be noted that, in arriving at the cost of Labor, Material and Indirect, three extensions are necessary. The firm above referred to has several thousand such items to be computed each month and they say that one Comptometer operator now does the work which formerly required several clerks.

## PRORATING

## CONTINUOUS PRORATING WITHOUT CLEARING THE MACHINE

There are some items in Prorating, Finding Average Costs, etc., where the following method facilitates the work:

## EXAMPLE:

In bleaching several lots of Straw Board, the chemical cost for all is \$5.469.

How much of the chemical cost should be charged against each lot?

		METHOD
Lot "A"	286 lbs.	Find the cost per pound.
" "B"	17 "	
" "C"	11 "	$5.469 \div 379 = .01443$ .
" "D"	42 "	
" "E"	23 "	
	<u>379</u> "	Multiply each lot by the chemical cost per lb., multiplying from the left of the Keyboard.

Commence with the lowest number of pounds. After noting, leave each result in the machine and multiply by the **difference** between the weight last used and the next higher. The largest weight is in three figures, so first hold Key Position on 11 in second and third columns from the left.

		COST OF LOT
		$11 \times 1443 = .159$ "C" Leave in the Register and
multiply (17-11)		$6 \times 1443 = .245$ "B" " " " " "
	(3rd col.) (from L.)	
" (23-17)		$6 \times 1443 = .332$ "E" " " " " "
" (42-23)		$19 \times 1443 = .606$ "D" " " " " "
" (286-42)		$244 \times 1443 = 4.127$ "A"
		<u>5.469</u>

and the total proves against the original chemical cost.

## MANUFACTURING COST

The Labor Cost Data is worked up in many different ways. Some factories desire a detailed analysis of the Labor Cost of the finished product for each individual operation, also the loss sustained through the pieces scrapped for each operation, some of the work being done by day work, others piece work.

We illustrate herewith a Labor Cost Sheet worked out complete on this order. The time has been transferred from the Work Tickets to the Labor Cost Sheet, also the number of good pieces finished by each department or operation and the day rates.

The Piece and Burden Rate are found in the small table accompanying.

The extensions on the Labor Cost, Scrap Cost, etc., are entered on the Recap. Sheet "C."

116 FINISHED  
10 SCRAPPED M321-A

LABOR COST SHEET (I)

M321-B  
128 BRAKE LEVERS

PC WORK BURDEN RATES	
RATES	May 1. HR.
	HARD'NG 021
	SAND BLAST 017
.03	DRILL 054
.05	LATHE 175
.04	POTTER & J. 22
.02	BENCH 234
.045	MILL 251
	1ST ASSMY. 212
	ETC

### METHOD

128 Brake Levers are started through the Sand Blast Department. The extension for the time, 4 hours, at the day rate of 18c per hour, is entered on the Recap. Sheet "C."

The Drill Press receives 128 Levers but completes only 124, i. e., four pieces are scrapped.

Day Work is 4 hours @ 18c, and  
4 " @ 26c

Accumulated, equals . . . \$1.76

Piece Work is 60 pcs @ 3c  
10 " @ 3c

Accumulated, equals . . \$2.10

Both these results are entered on the Recap. Sheet "C."

The Labor Cost for each operation is handled in the same manner.

## ANALYZING THE SCRAPPAGE

We want to determine the loss in Scrappage in each department, as well as the total.

## DRILL PRESS SCRAP

The time loss at the Drill Press will now be on its own and all subsequent scrappage, so we first find the average time on the pieces finished in this operation.

The total of 18.5 hours  $\div$  124 = .1492 hours per piece  
 Total unfinished— $12 \times .1492$  = 1.79 hours (To Recap.)  
 $18.5 - 1.79$  = 16.71 hours on finished stock  
 (To Recap.)

The four pieces scrapped were on Piece Work Basis at 3c each  
 $4 \times .03$  = .12 (To Recap.)

The hours on Scrap times the Burden Rate = the Burden  
 $1.79 \times .054$  = .097

The other operations are treated in a similar manner and each column on the Recap. Sheet added.

M321 C		RECAP. SHEET				SCRAP		
OPERATION	PCS	HRS	DAY WK	PC. WK		HRS.	MONEY	BURD.
SAND BL.	128	4	.72					
DRILL	124	16.71	1.76	2.10	4SC.	1.79	.12	.097
LATHE	121	15.41	3.57	1.30	3 -	1.09	.10	.191
P.&J	120	3.97	.96		1 -	.17		.0374
MILL	116	14.97	3.11	1.26	1/2 L.	.53	.09	.133
	116	55.06	10.12	4.66	12	3.58	.31	.458

## THE FINAL COST SHEET

The Labor and Burden Cost of each operation is gathered from Recap. Sheet, and, together with the "Material Cost," from another source, forms the Total Cost, 38.407.

This, divided by the number of finished pieces,  
 equals the Unit Cost .3311

The Material Cost on Scrap is found by finding  
 the Unit Cost of all the pieces originally  
 started through.  $15.33 \div 128 =$  .1198

12 pieces scrapped —  $12 \times .1198 =$  1.438

A thorough study of this Labor Cost Work will be very  
 beneficial in analyzing Cost Work of any nature.

COST SHEET		128 Brake Levers, M321D			
HARD'G.	LABOR	BURD.	Started WK.5-15-12		
SAND BL.	.72	.068	Finished - 6-9		
DRILL	3.86	.902	SCRAP RECORD		
PICKLE			PCS	HRS.	MONEY
BENCH			LOST		
LATHE	4.87	2.697	TOTAL	12	
P.&J.	.96	.873	Finished Pcs sent to Stock 116		
MILL ETC.	4.37	3.757	Mat'l. Cost 15.33		
	14.78	8.297	Labor 14.78		
			Burden 8.297		
			TOTAL COST 38.407		
			Cost Each .3311		

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**JOB LABOR COST SHEET  
IN A WOOD-WORKING FACTORY**

**THE OLD WAY**

**No. 109**

*#10 Halls Bros & Co*

The cut in adjoining column illustrates a Job Labor Cost Sheet at a Cabinet and Furniture Factory previous to applying a Comptometer. It is a fair example of the large amount of unnecessary work found in many offices.

**THE OPERATIONS WERE:**

1st. Figure the current day labor cost and enter on a scratch pad (to be added on pad later.)

2nd. Add mentally each current day wage to previous running total and enter result in the labor cost column.

3rd. Carry forward all the previous day's unchanged totals.

4th. Add the accumulated wages.

5th. Add the current day's labor on pad.

6th. Add the total of current day's wages to previous total to prove against current total.

While this proved the additions there was no check on the accuracy of the "current day extensions."

Working up one day's Labor Cost on this job therefore necessitated:

1. Making nearly 400 figures.
  2. Adding about 25 labor extensions to the previous totals.
  3. Adding the labor for the day.
  4. Adding the totals of accumulated wages.
-

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**JOB LABOR COST SHEET—Continued****THE COMPTOMETER METHOD****THE SAME RESULTS ARE OBTAINED IN THREE  
OPERATIONS WITH THE COMPTOMETER**

This shows what you can accomplish in economy on Payroll Work by analyzing each step and eliminating all unnecessary work.

**METHOD**

1st. Extend the current day wage and enter directly on the labor cost sheet.

2nd. Add the current day's labor costs.

3rd. Accumulate (hours by rates) with Fixed Decimal, the current day's labor, proving against total already obtained and add previous running total for Job Labor Cost to date.

You eliminate 45 mental additions; eliminate the writing of about 300 figures; complete the work in one-half the time; have a positive proof on every extension and footing.

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## SALES ANALYSIS

The form herewith will partially illustrate the results usually required in the sales analysis.

The Net Sales and Net Costs for each Department are abstracted to the Sales Analysis Sheet and the desired data worked up from same.

Salesman		Sal'y. & Exp's.		Month of		1913.	
<i>Wm. Ayle</i>		<i>\$465.00</i>		<i>June</i>			
Dept.	Sales	Dept. % of Sales	Net Cost	Gross Cost	% of Profit		
"A"	134.65	1.24	92.60	110.78	17.73		
"B"	1760.43	16.17	1242.35	1480.01	15.93		
( "C"	5640.96	51.80	3724.78	4486.31	20.47		
(to "J"							
"K"	817.20	7.5	645.32	755.64	7.54		
"L"	2536.50	23.29	1962.40	2304.83	9.12		
TOTAL	10889.74	100%	7667.45	9137.57	16.09		
TOTAL BURDEN		<i>\$15,156.80</i>		Percent of Burden to Sales		<i>13.5%</i>	
TOTAL SALES		<i>\$112,272.69</i>		Direct Cost Percent		<i>4.27%</i>	

Comptometer Results are shown in pen and ink script.

The Results Wanted are:

The Total Sales.

The Net Cost.

The Percent of Burden.

The Gross Cost.

The Departmental Percent of Sales.

The Departmental Percent of Profit.

The Percent of Sales Cost in Salary and Expense.



## SALES ANALYSIS—Continued

### COMPTOMETER METHOD

#### Adding:

Add the sales items on right side of Keyboard to a total, i. e., \$134.65, \$1760.43, etc., = \$10,889.74, the Sales made by Wm. Axle for the month.

Clear and add the Net Cost Items, \$92.60, \$1242.35, etc., = \$7,667.45.

#### Find Percent of each Salesman's Department Sales.

~~Add in the Total of Axle's Sales on the right of Keyboard, \$10,889.74.~~

Divide the amount of Sales in each department by his Total Sales for the month. As the divisor, \$10,889.74, will be constant for all departments, use the Reciprocal Method, i. e., add 1 in the Comptometer at the left and divide by the sales, 10,889.74 (use as 1,089), = 91,827, the reciprocal. (See Reciprocal Method for Pointing Off.)

Hold this as Key Factor at the left of Keyboard and multiply the Department Sales, \$134.65. (Split the Key Factor, using first 918, then 27) = 1.24%.

Continue in this manner for all department percentages.

#### Find the Percent of Burden.

Find the percentage of the "Burden" for the month to either the Sales or the Cost of the goods sold. Then, add the amount represented by this percentage to the net cost. In this example we have based the percentage on the sales — (carry the percent to the third decimal).

Add the Burden, \$15,156.80, in the Comptometer at the left and divide by the amount of Sales, \$112,272.69, (use

as 1,123, because quotient is wanted only to the third place) = .135.

#### Find the Gross Cost in each Department.

The Net Sales for Dept. "A" is \$134.65 and the percent of burden is .135. Hold the percent, .135 on the right of Keyboard and multiply the amount of sales, \$134.65 = \$18.18, which will be in the Fixed Decimal position. Leave it in the register and add to it the Net Cost, \$92.60 = \$110.78, the Gross Cost.

#### Figure the Percent of Profit by the Negative Method.

Leave the Gross Cost, \$110.78, in the register and divide by the Sales, \$134.65 = 82.27% Cost. Hold back the Cut-Off at the left of 82.27 and add its negative (small 8,226) twice directly over itself (see Negative Percent), = 17.73% Profit.

Figure all Departmental Gross Costs and Percent of Profit in the same manner.

#### The Percent of Cost to Sell

Add the amount of Salary and Expenses, \$465.00, in the Comptometer at the left and divide by the Amount of Sales, \$10,889.74 (use as 1,089), = 4.27%.

While wholesale houses may differ in the results desired, this, in the main, is typical of the general run of Sales Analysis Work.

## A SAFE WAY OF FIGURING COSTS

The following estimate includes cost of labor and material with burden and hazard allowances by a Metal Parts Mfg. Co.

### PRODUCTIVE LABOR AND MATERIAL

30 hrs. Labor.....	@ .45	
56— Iron.....	@ .04	
85— Steel.....	@ .03½	
11— Copper.....	@ .26	
2½— Aluminium....	@ .34	
		22.43
Plus 12½%.....		25.23

### SHOP OVERHEAD

Power, 30 k. w. hr....	@ .09	
Light, 22 k. w. hr....	@ .09	
Heat.....	2.20	
18 hrs. Labor.....	@ .17½	
		10.03
Plus 15%.....		11.53

### GENERAL OVERHEAD

Bookkeeper, 4 hrs ...	@ .37½	
Supt., 23 hrs.....	@ .65	
Insurance.....	.75	
Rent.....	4.20	
		21.40
Plus 40%.....		29.96

	66.72	
Plus for Safety Margin 20%		80.06
Add for profit 50%		= 120.09

### METHOD

### PRODUCTIVE LABOR AND MATERIAL

Use the Fixed Decimal. Accumulate the labor and material by their prices..... = \$22.43

Add 12½%—i. e.,

Leaving this amount in the Fixed Decimal position, also, jot it down on a pad and then merely multiply over the Fixed Decimal  $22.43 \times .125$ ..... = 25.23

In this manner you have simply added 12½% to 22.43, which was already in the machine.

Treat the Shop Overhead and the General Overhead in the same way.

After figuring the General Overhead, the result, 29.96 is in the Fixed Decimal position. Add to it, in this position, the amount of Shop Overhead and Labor and Material = 66.72

Increase this amount by 20% ..... = 80.06  
And then by 50% for profit ..... = 120.09  
i. e., leave the amounts in the machine and increase by the 20 and 50%'s in the same way as employed for 12½%.

Or, if the item of Safety Margin is not required, combine these two per cents as follows:

The Basis is \$66.72 or 100%.

Increase this by 20%, equals 120%, and again increasing this by 50% is  $120\% \times 50\%$  or 60% more, i. e., a total of  $120\% + 60\% = 180\%$  of \$66.72. This is an increase of 80%; therefore leave the item, 66.72 in the Fixed Decimal position and multiply  $66.72 \times .80$  over the Fixed Decimal..... = 120.09  
or clear the machine and multiply 180% by 66.72..... = 120.09

## FIGURING LIST AND SELLING PRICES

FIND THE SELLING PRICE  
MAKING 20% ON " "

PRIME COST	\$165.00
BUYERS COM.	5%
EXPENSES	4 75
1 <sup>ST</sup> FIND COM.	\$8.25
2 <sup>ND</sup> GROSS COST	178.00
3 <sup>RD</sup> SELLING PRICE	222.50
4 <sup>TH</sup> PROFIT	44.50

GROSS COST =

PRIME COST + COM + EXPENSES  
SELLING PRICE = 100%.

PROFIT BEING 20%.

GROSS COST IS 80%:

$$1\% = \frac{1}{80} \text{ OF } 178.00 = 2.225$$

$$\text{HENCE S.P. (OR 100\%)} = 100 \times 2.225 \\ = \underline{\underline{222.50}}$$

ARTICLE COSTS \$3.80 LESS 25 and 10%

FIND SELLING PRICE { TO MAKE :-  
10 % FOR EXPENSES  
17 - - SELLING COST  
15 - - PROFIT

METHOD { GET NET COST \$2.565  
S.P IS 100 %  
GROSS- PROFIT IS 42 %  
COST MUST BE 58 %  
IF 2.565 = 58% THEN 1%  
=  $\frac{1}{58}$  TH OF 2.565 ( $\times 100 = \text{S.P}$ )  
= \$4.42

FIND LIST PRICE TO ALLOW A  
DISCOUNT OF 10-10 and 20%

METHOD { LIST PRICE = 100%  
DISCOUNT = .352%  
THEREFORE S.P = 648 Etc  
THEN  $\frac{4.42}{648} \times 100\%$  OR L P  
= \$6.82



**COMPTOMETER APPLICATION  
TO  
VARIOUS LINES OF BUSINESS**

## LUMBER AND WOODWORKING

### WHERE AND HOW THE COMPTOMETER IS USED IN LUMBER AND WOODWORK ACCOUNTING

#### Bookkeeping Department

- Adding and balancing cash books.
- Adding daily sales, voucher and charge sheets.
- Adding deposit slips and checks.
- Adding monthly statements.
- Adding and figuring all statistical work.
- Adding distribution of cash and charge sales  
direct from charge slips or from copied book  
records.
- Proving daily postings.
- Balancing ledger accounts.
- Taking off trial balance.
- Figuring and proving freight bills, etc.
- Proving extensions on purchase invoices.
- Extending and adding inventories.
- Figuring interest on notes and anticipations.

#### Estimating Department

- Figuring, totaling and proving all extensions  
of quantity and price.

#### Billing Department

- Original figuring of board feet.
- Price extensions and footings.
- Taking off discounts.
- Proving invoice extensions and additions.
- Figuring and totaling lumber tallies.
- Figuring and totaling foreign shipments.
- Converting British currency, etc.

#### Cost Department

- Figuring piece costs.
- Figuring and totaling job costs.
- Figuring prorate percentage of cost per piece,  
job or department.

#### Timekeeping

- Figuring time cards.
- Extensions on pay rolls per day, hour, piece,  
hundred, etc.
- Making up money denominations.
- Totaling pay rolls.
- Figuring averages and rates per hour

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## LUMBER FIGURING

Lumber is usually sold by the thousand (M) Board Feet.

A Board Foot:—Is the equivalent of a board 1" thick  $\times$  12" wide  $\times$  12" long. Any thickness less than 1" is usually figured the same as one inch.

To find the board feet in a piece of lumber:

EXAMPLE—1 piece  $2\frac{1}{2}" \times 18" \times 22'$   
 $\frac{\text{Thickness} \times \text{width} \times \text{length}}{12}$  equals the board feet.

Multiply  $2\frac{1}{2} \times 18 \times 22 = 990 \div 12 = 82'6"$

In figuring the board feet you can make a mental division of 12 into any factor with same results, e. g.,  $18 \div 12 = 1\frac{1}{2}$ . Then on Comptometer  $22 \times 1\frac{1}{2} \times 2\frac{1}{2} = 82'6"$

Lumber  
Table  
of  
Board  
Feet

Size	8 Ft.	10 Ft.	14 Ft.	16 Ft.	18 Ft.	20 Ft.	22 Ft.	26 Ft.	Size	9 Ft.	11 Ft.	13 Ft.	15 Ft.	17 Ft.	19 Ft.
1 x 4	2.667	3.333	4.667	5.333	6.	6.667	7.333	8.667	1 x 4	3.	3.667	4.333	5.	5.667	6.333
1 x 5	3.333	4.167	5.833	6.667	7.5	8.333	9.167	10.833	1 x 5	3.75	4.583	5.417	6.25	7.083	7.917
1 x 8	5.333	6.667	9.333	10.667	12.	13.333	14.667	17.333	1 x 8	6.	7.333	8.667	10.	11.333	12.667
1 x 10	6.667	8.333	11.667	13.333	15.	16.667	18.333	21.667	1 x 10	7.5	9.167	10.833	12.5	14.167	15.833
1 x 14	9.333	11.667	16.333	18.667	21.	23.333	25.667	30.333	1 x 14	10.5	12.833	15.167	17.5	19.833	22.167
1 x 16	10.667	13.333	18.667	21.333	24.	26.667	29.333	34.667	1 x 16	12.	14.667	17.333	20.	22.667	25.333
1 x 18	12.	15.	21.	24.	27.	30.	33.	39.	1 x 18	13.5	16.5	19.5	22.5	25.5	28.5
1½ x 4	3.333	4.167	5.833	6.667	7.5	8.333	9.167	10.833	1½ x 4	3.75	4.583	5.417	6.25	7.083	7.917
1½ x 8	6.667	8.333	11.667	13.333	15.	16.667	18.333	21.667	1½ x 8	7.5	9.167	10.833	12.5	14.167	15.833
1½ x 10	8.333	10.417	14.583	16.667	18.75	20.833	22.917	27.083	1½ x 10	9.375	11.458	13.542	15.625	17.708	19.792
1½ x 14	11.667	14.583	20.417	23.333	26.25	29.167	32.083	37.917	1½ x 14	13.125	16.042	18.958	21.875	24.792	27.708
1½ x 16	13.333	16.667	23.333	26.667	30.	33.333	36.667	43.333	1½ x 16	15.	18.333	21.667	25.	28.333	31.667
1¾ x 4	4.	5.	7.	8.	9.	10.	11.	13.	1¾ x 4	4.5	5.5	6.5	7.5	8.5	9.5
1¾ x 8	8.	10.	14.	16.	18.	20.	22.	26.	1¾ x 8	9.	11.	13.	15.	17.	19.
1¾ x 10	10.	12.5	17.5	20.	22.5	25.	27.5	32.5	1¾ x 10	11.25	13.75	16.25	18.75	21.25	23.75
1¾ x 14	14.	17.5	24.5	28.	31.5	35.	38.5	45.5	1¾ x 14	15.75	19.25	22.75	26.25	29.75	33.25
2 x 4	5.333	6.667	9.333	10.667	12.	13.333	14.667	17.333	2 x 4	6.	7.333	8.667	10.	11.333	12.667
2 x 8	10.667	13.333	18.667	21.333	24.	26.667	29.333	34.667	2 x 8	12.	14.667	17.333	20.	22.667	25.333
2 x 10	13.333	16.667	23.333	26.667	30.	33.333	36.667	43.333	2 x 10	15.	18.333	21.667	25.	28.333	31.667
2 x 14	18.667	23.333	32.667	37.333	42.	46.667	51.333	60.667	2 x 14	21.	25.667	30.333	35.	39.667	44.333
2 x 16	21.333	26.667	37.333	42.667	48.	53.333	58.667	69.333	2 x 16	24.	29.333	34.667	40.	45.333	50.667
3 x 10	20.	25.	35.	40.	45.	50.	55.	65.	3 x 10	22.5	27.5	32.5	37.5	42.5	47.5
3 x 14	28.	35.	49.	56.	63.	70.	77.	91.	3 x 14	31.5	38.5	45.5	52.5	59.5	66.5
3 x 16	32.	40.	56.	64.	72.	80.	88.	104.	3 x 16	36.	44.	52.	60.	68.	76.
4 x 4	10.667	13.333	18.667	21.333	24.	26.667	29.333	34.667	4 x 4	12.	14.667	17.333	20.	22.667	25.333
4 x 8	21.333	26.667	37.333	42.667	48.	53.333	58.667	69.333	4 x 8	24.	29.333	34.667	40.	45.333	50.667
4 x 10	26.667	33.333	46.667	53.333	60.	66.667	73.333	86.667	4 x 10	30.	36.667	43.333	50.	56.667	63.333
8 x 8	42.667	53.333	74.667	85.333	96.	106.667	117.333	138.667	8 x 8	48.	58.667	69.333	80.	90.667	101.333
8 x 10	53.333	66.667	93.333	106.667	120.	133.333	146.667	173.333	8 x 10	60.	73.333	86.667	100.	113.333	126.667
8 x 14	74.667	93.333	130.667	149.333	168.	186.667	205.333	242.667	8 x 14	84.	102.667	121.333	140.	158.667	177.333
10 x 10	66.667	83.333	116.667	133.333	150.	166.667	183.333	216.667	10 x 10	75.	91.667	108.333	125.	141.667	158.333

In  
Various  
Lengths  
and  
Sizes

## LUMBER FIGURING—Continued

There are two methods of determining the Board Feet in a bill of lumber.

### OLD METHOD

Is to find the number of Board Feet in each size and then add these results for the total. The separate extensions can be worked up in the same manner on the Comptometer in much less time and with great ease and accuracy.

Find the Board Feet in each size of the following and the value of the total at \$28.50 per M:

80	pcs	Pine	1"	x10"	x16'
45	"	"	1½"	x14	x16
37	"	"	1¼"	x16	x20
75	"	"	2	x 8	x22

You will find the Lumber Table, on preceding page, a great help in figuring these lumber quantities.

First, find the number of feet for the given size and multiply by the number of pieces, thus: 1"×10"×16' contains 13.333 ft., therefore—

80	x13.333	=1067
45	x28.	=1260
37	x33.333	=1233
75	x29.333	=2200

Adding these items                      =5760'

Clear the machine and multiply the feet by the price, i. e.,  $5760 \times \$28.50 = \$164.16$ .

### SHORT COMPTOMETER METHOD

As a rule, nothing is gained by finding the number of feet in each piece, but the main point is to determine the number of feet in the several sizes and quantities that are subject to the same price. The Comptometer makes it practical to determine the total number of Board Feet in the several sizes. Use the Lumber Table for the number of feet in each size and multiply over the Fixed Decimal the number of pieces by the feet in each respective size, accumulating to the total.

80	x13.333
45	x28.
37	x33.333
75	x29.333

Equals a total of                      5760 Bd. Ft.

With a 10-column, or larger Comptometer, you can leave the feet in the machine and multiply directly by the price per M.

### A MENTAL SHORT CUT

One accustomed to figuring Lumber in reducing to Board Feet will divide mentally any factor easily divisible by 12.

The short cuts, to which the Lumberman is accustomed, can be used in connection with the Comptometer, and his work facilitated to a great extent.

#### EXAMPLES:

35 pieces 2×8×18  
Divide 18 by 12, mentally = 1½  
Then,  $1\frac{1}{2} \times 2 \times 8 \times 35$ , on Comptometer = 840 Ft.

36 pieces 2×8×16  
Divide 36 by 12, mentally = 3  
Then,  $3 \times 2 \times 8 \times 16$ , on Comptometer = 768

If only the amount is wanted, the price may be divided by 12;

27 pieces  $1\frac{1}{4} \times 10 \times 16$  @ \$36.00 M.  
Divide 36.00 by 12 mentally = 3  
Then,  $3 \times 27 \times 1\frac{1}{4} \times 16 \times 10$  on Comptometer = \$16.20



**HARDWOOD LUMBER**

Hardwood is frequently so irregular in sizes that, many times, it is more advantageous to work up each item separately. In doing this, you would employ one of the two following methods:

**EXAMPLE:**

246 pieces White Oak  $2\frac{3}{4}" \times 7\frac{1}{2}" \times 16'$ .

**METHOD 1**

Multiply the three dimensions  $2.75 \times 7.5 \times 16$  and divide by 12, which equals the Board Feet for one piece.

$$\begin{aligned} 2.75 \times 7.5 \times 16 &= 330 \\ 330 \text{ divided by } 12 &= 27.5 \\ 246 \text{ pieces} \times 27.5 &= 6,765 \text{ ft.} \\ 6765' @ \$36.00 \text{ per M.} &= \$243.54 \end{aligned}$$

**METHOD 2**

Refer to the Decimal Table below for the decimal of a foot of one dimension, then multiply this factor by the other two dimensions and the number of pieces, which equals the total Board Feet, thus:

$$\begin{aligned} 2\frac{3}{4}" &= .2292 \text{ ft.} \\ .2292 \times 7.5 \times 16 &= 27.504 \text{ B. F. per pc.} \\ 27.5 \times 246 \times \$36.00 &= \$243.54 \end{aligned}$$

With the 8-column Comptometer, extend the Bd. Ft. first over the Fixed Decimal. Then clear the machine and extend by the pieces and price.

With the 10 or 12-column Comptometer, you will figure this complete without clearing the machine.

**DECIMALS OF A FOOT FOR EACH  $\frac{1}{8}$  OF AN INCH, TO BE USED IN CONNECTION WITH THE COMPTOMETER IN FIGURING LUMBER, STEEL BEAMS, ANGLES, ETC.**

	0"	1"	2"	3"	4"	5"	6"	7"	8"	9"	10"	11"
		.0833	.1667	.2500	.3333	.4167	.5000	.5833	.6667	.7500	.8333	.9167
$\frac{1}{8}"$	.0104	.0937	.1771	.2604	.3437	.4271	.5104	.5937	.6771	.7604	.8437	.9271
$\frac{1}{4}"$	.0208	.1042	.1875	.2708	.3542	.4375	.5208	.6042	.6875	.7708	.8542	.9375
$\frac{3}{8}"$	.0312	.1146	.1979	.2812	.3646	.4479	.5312	.6146	.6979	.7812	.8646	.9479
$\frac{1}{2}"$	.0417	.1250	.2083	.2917	.3750	.4583	.5417	.6250	.7083	.7917	.8750	.9583
$\frac{5}{8}"$	.0521	.1354	.2188	.3021	.3854	.4688	.5521	.6354	.7188	.8021	.8854	.9688
$\frac{3}{4}"$	.0625	.1458	.2292	.3125	.3958	.4792	.5625	.6458	.7292	.8125	.8958	.9792
$\frac{7}{8}"$	.0729	.1562	.2396	.3229	.4062	.4896	.5729	.6562	.7396	.8229	.9062	.9896

## LUMBER FIGURING

### BY THE FIXED DECIMAL METHOD WITH 12-COLUMN COMPTOMETER

This is an excellent method for figuring lumber, especially if a firm has quite a few of these problems to figure. It enables the estimator to do the major portion of his lumber figuring without a change in decimal pointing in one continuous operation for any problem.

#### Example:

386 pieces  $2\frac{1}{2} \times 4\frac{1}{2} \times 13' 6''$  @ \$24.50 per M.

#### METHOD

##### Use a 12-Column Comptometer:

Pull down the following Decimal Pointers:

Between the 5th and 6th Columns,

Between the 8th and 9th Columns.

These Decimal Pointers will be referred to as No. 1 and No. 2, respectively.

##### Determine the Board Feet:

$$386 \times 2\frac{1}{2} \times \frac{4\frac{1}{2}}{12} \times 13\frac{1}{2} = \text{Board Feet.}$$

First, hold 386 over the Fixed Decimal, No. 1, and multiply by the decimal for  $\frac{4\frac{1}{2}}{12}$  (.375), which you find on the "Decimal of a Foot" table.

Move to the right for the decimal (.3) and multiply towards the right = 144.75.

Now, using 3-Factor Method 2, holding the registered amount for Key Factor— $144.75 \times 2.5$

Hold the answer in the register, 144.75 for Key Factor, and multiply the thickness, 2.5, Fixed Decimal Method. Split the Key Factor and hold first 144. right over itself and multiply. Then use the .75. This Key Factor being **in the register once**, multiply only once in the units position, = 361.875.

$$361.875 \times 13.5$$

Hold the registered amount, 361.875, for Key Factor, splitting; using first 361, then .875, and multiply 13.5 the Fixed Decimal way, i. e., first holding 361. right over itself is the position for multiplying the **unit (3)** of the multiplicand; therefore move to the left one place and commence multiplying 13.5 towards the right, making **one less** depression in the **unit place**, because 361.875 is in the register once. Upon multiplying by the 361, move the fingers to the right for the relative position on 875 and multiply back towards the left, = 4885.3125 Board Feet.

---

**FIXED DECIMAL METHOD—Continued**Fixed Decimal  
No. 2Fixed Decimal  
No. 1

Now, for the **Thousand Feet**, look at the quantity over Fixed Decimal No. 2—you have 4.8853125 Thousand Feet @ \$24.50 per Thousand.

Again hold the registered amount directly over itself for **Key Factor**, splitting; using first 488, then 531, and multiply, Fixed Decimal Way, 24.5, multiplying one less in the units position = \$119.69.

No. 2

No. 1

---

## FIGURING LUMBER TALLIES

## METHOD 1—VARYING SIZES

Where individual quantities are desired, make extensions singly. Then add the feet for total, clear the machine and multiply by the price.

90 pcs. 2" × 4" — 12'	720
323 " 2 × 4 — 12	2584
34 " 2 × 6 — 16	544
2 " 4 × 4 — 14	37
4 " 4 × 4 — 18	96
36 " 4 × 6 — 18	1296
	<hr/> 5277'
@ \$24.65 . . . .	\$130.08

## METHOD 2

If only the total Bd. Ft. is required use the Lumber Table and multiply accumulatively over the Fixed Decimal. Then clear the machine and multiply by the price.

90 × 8	
323 × 8	
34 × 16	
2 × 18.667	
4 × 24	
36 × 36	<hr/>
	5277' @ \$24.65 = \$130.08

## METHOD 1—ONE SIZE, VARYING QUANTITIES AND LENGTHS

If a Tally Sheet contains one size and varying quantities of the different lengths, multiply the length by the quantity, i.e.,  $10 \times 41$ ,  $12 \times 13$ , etc., accumulating to the total lineal feet of this size. Then multiply by the thickness and width and divide by 12, i. e.,  
 2020 lineal feet by  $2 \times 8 \div 12 =$   
 2693 $\frac{1}{3}$  ft.

Example:  
 2 × 8 No. 1

	Lgth.	Pcs.	Ft.
	8	—	
	10	41	
	12	13	
	14	26	
	16	26	
	18	14	
	20	13	
	22	3	
	24	4	
2020 × 1.3333 ( $\frac{2 \times 8}{12}$ ) = 2693 $\frac{1}{3}$	Bd.		<hr/>
	Ft.		2020'

## METHOD 2

With the Fixed Decimal Method multiply the number of pieces of each length by the board feet in each piece. Finding same on Lumber Table, e. g.

41 × 13.333	
13 × 16.	
26 × 18.667	
26 × 21.333	
14 × 24	
13 × 26.667	
3 × 29.333	
4 × 32	<hr/>
	2693.33

**LUMBER TALLIES**

In checking the number of "Pieces" of each size in carload shipments of lumber many use a Tally Sheet on the following order:

JOHN JONES LUMBER CO.

TALLY SHEET

SIZE	TOTAL NO. BOARDS
1 x 8 x 12	55
1 x 8 x 14	66
1 x 8 x 16	27
1 x 8 x 18	35
1 x 10 x 12	65

10 boards are recorded in each square, therefore in checking this tally sheet place the first and second fingers on the "1" keys in the units and tens columns:

With the first finger in the tens column add 10 boards for each full square, then add odd boards with the second finger in the units columns.

**VENEER**

Veneer is figured the same as other lumber, i.e., any thickness treated the same as though it were 1" thick and sometimes figured at actual thickness.

EXAMPLE:

14 Strips Mahogany  $\frac{3}{8}" \times 3\frac{1}{2}" \times 4'$  @ \$175.00 per M.

**FIGURED AS 1" THICK**

Multiply the dimensions and pieces and then divide by 12.

$$\frac{3\frac{1}{2} \times 4 \times 14}{12} \text{ equals } 16\frac{1}{3} \text{ ft.}$$

$$16\frac{1}{3} @ \$175.00 \text{ per M} = \$2.86$$

**FIGURED BY ACTUAL THICKNESS**

14 Strips Mahogany  $\frac{3}{8}" \times 3\frac{1}{2}" \times 4'$  @ \$175.00 per M.

$\frac{3}{8}"$  equals .0313 of a foot—from Decimal Table; therefore,  $.0313 \times 3.5 \times 4$  equals .4382 Bd. Ft. per piece.  $.4382 \times 14$  equals 6.135 ft. @ \$175.00 M equals \$1.07.

When figuring lumber for individual results—

Use the Fixed Decimal (p.42) and look upon the price as price per foot.

i. e., 172 ft. @ \$36.50 M or .0365 per ft. equals \$6.28; or take first key position on the adding columns of the price, i.e., on \$36.50 on the right side of key board (it amounts to the same thing), multiplying towards the left.

The decimal in the answer is always in the same place between the 5th and 6th columns.

## LUMBER-BILLING

## EXAMPLE:

132 ft. Hemlock @ \$24.50	\$ 3.23
14,763 ft. Spruce @ 28.75	424.44
1,024 ft. Oak @ 42.00	43.01
	<u>\$470.68</u>

27 pcs. Ga. Pine 3x6x16 (=648 Bd. Ft.) @ \$28.50	\$18.47
65 pcs. Ga. Pine 1½x10x16 (=1083 Bd. Ft.) @ \$32.45	<u>35.14</u>
	\$ 53.61
246 pcs. White Oak 2¾x7½x16 (=6765 Bd. Ft.) @ \$36.00	<u>243.54</u>
	<u>\$297.15</u>

6 Doors 1½x2'6"x6'8" @ \$ 8.60	
5 Doors 1½x3' x7' @ 12.50	
	<u>\$114.10</u>
Less 55-5%	\$48.78
8 Doz. Chairs No. 4675 @ \$9.00	72.00
Less 25%	54.00
4½ Doz. Chairs No. 5742 @ \$14.50	65.25
Less 35%	<u>42.41</u>
	<u>\$145.19</u>

In the original extension of invoices figure each item separately, then add the results for the total of invoice.

To insure Absolute Accuracy prove all invoices by re-figuring the extensions over a Fixed Decimal.

This gives the grand total in one amount and proves the extensions and additions in one operation.

By this method of billing, estimating and invoicing you can increase the efficiency from 25 to 75%.

## STANDARDS

Problems on the order of the following are frequently found in connection with foreign shipments:

## EXAMPLE:

388 Standards @ 7½ Centimes per sq. in. one meter long.

The English Standard contains 1980 Board Feet.

One Board Foot " 144 Sq. in.

One Meter is 39.37"

Therefore, to get the unit of measure—

Multiply  $1980 \times 144 = 285,120$  sq. in. ÷ by 39.37 = 7242.06

Units (or sq. in. 1 meter long in one Standard)

Standards.	Units per Std.	Total units.
------------	----------------	--------------

388 × 7242.06 = 2809919.28 × 7½ Centimes

Equals 21074394.6 Centimes.

To Reduce To Francs:

100 Centimes make one Franc; therefore, point off two places—equals 210743.946 Francs.

To Convert to U. S. Currency:

Multiply Francs by .1942 cts. per Franc = 40926.47

## DISTRIBUTION OF SALES

## BY THE DIRECT METHOD

The advantages of the direct method with the Comptometer are:

That it deals directly with the original data.  
Saves much unnecessary copying from original records in the sales distribution book. Every copying of original data presents one more opportunity for error.  
Gives complete proof of accuracy at every step.

Post direct from duplicate invoice to the ledger.

Prove ledger postings by adding on the Comptometer directly from your ledger, after the day's postings are completed. To facilitate proving, drop a marker in the ledger as each posting is made; then add the entries and balance against original total. (See Comptometer Method of Proving Daily Postings). Total the sales for the day by adding directly from the invoices.

Total the various distributions of sales such as:

Number of feet of lumber.      Amount of lumber sales.  
Amount of shingle sales.      Amount of lath sales.  
Amount of merchandise sales.

Working in this manner directly from the original figures, you get satisfactory proof of accuracy on all work.

The accuracy of daily sales footings is proved by balancing against the total of ledger postings and vice versa.

The accuracy of distribution totals is proven by adding the several distributions and balancing against total sales.

With a 12-column Comptometer two or three distributions can be added at the same time.

ACCOUNT NO		DISTRIBUTION OF										PAGES-MASTERS CO., MANUFACTURERS, CHICAGO NEW YORK		REGISTERED APR. 11, 1906	
A		B		C		D		E		F					
Date	NO	AMOUNT	NO.	AMOUNT	NO	AMOUNT	NO.	AMOUNT	NO.	AMOUNT	NO.	AMOUNT	NO.	AMOUNT	NO.
1	1728	5460	146	2678	76	3843	8	36-				1460	2190		
2	17362	34614	34	614											
3	6340	17264	165	2740								430	753		
4															
12															
29	34456	906726	5374	87846	432	6024	47	21860	78	2106	9430	15795			
30	1436	3826	72	1368											
31															
	346429	967890	5741	95194	4582	9167	55	75460	85	7351	11320	18738			

Distribution Sheet

### FIGURING PIPE STAVES

Western & South Western Lumber Companies have considerable of the following work. The lumber is used for making Wood Pipe for irrigation purposes, etc., usually in even foot lengths, but sometimes special lengths for irrigation.

Indicates 4 pcs. 11'-0" long

7 " 11'-1" "

5 " 11'-2" " Etc.

ORDER	SIZE	PIECE TALLY					QUANTITY
		11'	4 0"	7 1"	5 2"	2 3"	
			6 4"	5 5"	2 6"	3 7"	
			7 8"	5 9"	13 10"	12 11"	820
		14	23 0"	7 1"	6 2"	4 3"	
			4 4"	6 5"	3 6"	5 7"	
			7 8"	5 9"	8 10"	8 11"	1237
							2057

This is figured in Lineal Ft.

First add on the left of the Comptometer, the number of pieces for each "foot" length, i. e., add the number of pieces from 11' up to 11'11" long, etc.

4 Then on the right of Keyboard, hold the  
 7 inches for multiplier and multiply by the cor-  
 5 responding number of pieces, accumulating all  
 2 items in the 11 ft. group, etc.  
 6  
 5 i. e. 7×1 2×6 It is immaterial wheth-  
 2 5×2 3×7 er you held the inch  
 3 2×3 7×8 Key Position or the  
 7 6×4 5×9 number of pieces. The  
 5 5×5 13×10 former is better be-  
 13 12×11 cause of the ease of  
 12 moving to each suc-  
 71 468 ceeding multiplier.

Now with the total lineal inches in the Register reduce to feet by dividing by 12 equals 39.

Then multiply directly over this the number of pieces previously ascertained by the feet, i. e., 71 by 11. ANSWER:—820 Lineal Feet.



**COST WORK AND ESTIMATING**

In Woodworking Factories you will find much work on the following order:

50 pieces	1"×1' 5"	×16½"	. . .	97'5"
25 "	1"×1' 4"	×16¾"	. . .	46'6"
32 "	7/8"×1' 4"	× ¾"	. . .	2'8"
27 "	½"×1' 4½"	× 2¾"	. . .	8'6"
25 "	½"×1' 5"	×15½"	. . .	45'9"
38 "	1"×1' 4½"	×15½"	. . .	67'6"
27 "	1"×1' 3½"	×15½"	. . .	45'
				313'4"

Find the Board Feet in each size and the total Board Feet.

**METHOD 1**

Multiply the 3 dimensions together in inches and this by the number of pieces, then divide by 144.

1" by 17" by 16.5 by 50 equals 14025, which divided by 144 equals 97.4' or 97'5" exactly.

**METHOD 2**

The following is easier and quicker, but the Board Feet will be about ¾ of 1% more than actual, or one foot in each 125 feet, but the latter method is preferred by many.

The reciprocal of 144 is .00694. Use this as .007 and first multiply the 3 dimensions and the number of pieces as above, 1×17×16.5×50 equals 14025. Leave 14025 in the machine and multiply by .007, equals 98'2".

As the multiplicand, already in the Register, is equivalent to having multiplied by 1, use the 6 key.

**METHOD 3**

In many instances you can accumulate to a decided advantage. Multiply the pieces by the thickness and width jotting down each result:— thickness in the foregoing being 1" or less there is no calculation to make for same.

$$\begin{array}{rcl}
 50 \times 17'' & = & 850 \\
 25 \times 16 & = & 400 \\
 32 \times 16 & = & 512 \\
 27 \times 16\frac{1}{2} & = & 445\frac{1}{2} \\
 25 \times 17 & & \\
 38 \times 16\frac{1}{2} & \left. \vphantom{\begin{array}{l} 25 \times 17 \\ 38 \times 16\frac{1}{2} \end{array}} \right\} & = 1470\frac{1}{2} \\
 27 \times 15\frac{1}{2} & & 
 \end{array}$$

The last three items all being the same length, accumulate them.

Now accumulate these results by their respective lengths in inches.

$$\begin{array}{r}
 850 \times 16\frac{1}{2} \\
 400 \times 16\frac{3}{4} \\
 512 \times 00\frac{3}{4} \\
 445.5 \times 2\frac{3}{4} \\
 1470.5 \times 15\frac{1}{2} \\
 \hline
 45126.85
 \end{array}$$

Multiply by .007 or .00694 or divide by 144.

$$45126.85 \times .007 = 315'11''$$

or,

$$45126.85 ( \div 144 ) = 313'4'' \text{ exactly.} \\ ( \times .00694 )$$

This was figured on an 8 column Comptometer with 2nd decimal pointer from right. The Fixed Decimal on larger Comptometers=45126.875.

**COSTS AND ESTIMATING**

The following are examples of Cost Work and Estimating on which the Comptometer has increased the efficiency 30 to 80%, doing the work in from one-quarter to three-quarters of the time previously required.

Some manufacturers desire to have the exact quantity figured and then allow a certain per cent for waste.

**EXAMPLE:**

2 pieces  $62\frac{1}{2} \times 4\frac{1}{4} \times \frac{3}{4}$ ,"  
 6 "  $16\frac{1}{4} \times 4\frac{5}{8} \times \frac{3}{4}$ ,  
 4 "  $33 \times 2\frac{1}{4} \times 1$ ,  
 5 "  $22\frac{1}{4} \times 2\frac{3}{4} \times 1$ .

This work is figured in two ways.

**METHOD "A"**

Mentally multiply the number of pieces by the width or length, which ever is desired. Then multiply this result on Comptometer, using the Fixed Decimal, and accumulate for the total number of square inches for all stock of the same thickness. All pieces under 1" are reckoned as 1".

**Mentally On Comptometer with Fixed Decimal.**

e.g.,  $2 \times 4\frac{1}{4} = 8\frac{1}{2} \times 62\frac{1}{2}$   
 $6 \times 16\frac{1}{4} = 97\frac{1}{2} \times 4\frac{5}{8}$   
 $4 \times 2\frac{1}{4} = 9 \times 33$   
 $5 \times 2\frac{3}{4} = 13\frac{3}{4} \times 22\frac{1}{4}$  ———  
 Total Square in. . . . 1585  
 1585 divided by 144 = 11 Bd. Ft.

**METHOD "B"**

Some manufacturers treat each fraction of an inch as a whole inch. This allows liberally for waste and makes a more liberal margin for net profit.

The foregoing would then be figured as follows:

<b>Mentally</b>	<b>On Comptometer</b>
<b>Pieces <math>\times</math> Width</b>	<b>at Right of Keyboard</b>

$2 \times 5 =$	$10 \times 63$
$6 \times 5 =$	$30 \times 17$
$4 \times 3 =$	$12 \times 33$
$5 \times 3 =$	$15 \times 23$ ———

Total sq. in. . . . 1881  $\times .007$  (The reciprocal of 144) = 13 bd. ft.

## BOX FACTORIES

The figuring of lumber quantities in boxes includes the board feet in the sides, top, bottom, ends and frequently reinforcing strips, wire binding, etc.

Usually the sides, top and bottom of boxes are made of better material than the ends and must be figured separately.

EXAMPLE: Figuring the Board Feet  
A box  $30\frac{1}{2}$ " wide 34" high 42" long.

### METHOD

For the number of Board Ft. in the two sides, top and bottom.  $\left\{ \begin{array}{l} \text{Double the length and} \\ \text{multiply by the width} \\ \text{and height, accumulat-} \\ \text{ing, equals the square} \\ \text{inches.} \end{array} \right.$

$$\begin{array}{r} 42 \\ 42 \\ \hline 84 \end{array} \quad \begin{array}{r} \times 34 \\ \times 30\frac{1}{2} \hline \end{array} \quad \begin{array}{l} 5418 \text{ Sq. In.} \\ 5418 \div 144 = 37.62 \text{ Ft. per box} \end{array}$$

The more usual method is to leave the total sq. inches in the machine and multiply by .007 (p. 39) as the reciprocal of 144 (.06944). This is  $\frac{3}{4}$  of 1% more than actual in the result.

For the 2 ends:—

Double the height  $\times$  width  $\times$  .007 equals the Board Ft.  $30\frac{1}{2} + 30\frac{1}{2} = 61 \times 34 \times .007 = 14.518 \text{ Ft.}$

If the sides, top, bottom and ends are all figured together use the following formula:

Double the first dimension times the other two.

Double the second dimension times the last.

$$\begin{array}{r} 61 \times 34 \\ 61 \times 42 \\ 68 \times 42 \hline 7492 \times .007 = 52.444 \text{ Bd. Ft. per box.} \end{array}$$

Figure the area of a box:—

$$\begin{array}{l} 14\frac{3}{4} \times 13\frac{1}{2} \times 9\frac{1}{2} \\ \text{Double the 1st dimension} = 29\frac{1}{2} \times 13\frac{1}{2} \left. \begin{array}{l} \times 9\frac{1}{2} \end{array} \right\} \begin{array}{l} \text{accumulating over} \\ \text{a Fixed Decimal} \end{array} \\ \text{" " 2d} = 27 \times 9\frac{1}{2} \hline 935 \times .007 = 6.54 \text{ Ft.} \end{array}$$

Or multiply the first dimension by the other two and the second dimension by the last accumulating over a Fixed Decimal.

$$\begin{array}{l} 14\frac{3}{4} \times 13\frac{1}{2} \\ \times 9\frac{1}{2} \\ 13\frac{1}{2} \times 9\frac{1}{2} \hline 467.5 \end{array} \quad \begin{array}{l} \text{Then inasmuch as there are 2} \\ \text{sides, 2 ends, a top and a bottom,} \\ \text{divide this by 72 equals 6.49 Ft.} \\ \text{exact. This is the same as doubling} \\ \text{the sq. in. and dividing by 144.} \end{array}$$

## BOX FACTORY WORK—Continued

In many Box Factories lumber  $\frac{3}{8}$ " thick is considered as standard.

For  $\frac{1}{2}$ " lumber 25% is added.

"  $\frac{5}{8}$ " " 50% " "

"  $\frac{7}{8}$ " " 100% " "

**EXAMPLE :**

A box 18 x 16 x  $14\frac{1}{4}$ ". Top and sides to be  $\frac{3}{8}$ " thick. Ends  $\frac{5}{8}$ " thick.

**METHOD****Figure the ends first**

Double one of the end dimensions and multiply by the other, using the Fixed Decimal.

$$\begin{array}{r} 14\frac{1}{4} \\ 14\frac{1}{4} \end{array} \quad 28\frac{1}{2} \times 16 = 456$$

Increase this by 50%, i. e., with 456 in the Register, take Key Position on .5 and multiply by 456 moving to the left, equals .....684

or

Take Key Position on 456 over itself. Move to the right one column and multiply by .5, gives the same result 684 (or add one-half of 456 to itself).

Then, directly over this, multiply the width and height by twice the length, i. e. —

$$\begin{array}{r} 18 \\ 18 \\ \hline 18 \end{array} \quad \begin{array}{r} 36 \times 16 \\ 36 \times 14\frac{1}{4} \end{array}$$

1773 Sq. In.

Leaving this in the Register, multiply it by .007 (using the 6 key and commencing at the left, which will give the result in feet, 12.4 ft.

**Figure the Cleats**

The same box is supplied with cleats  $\frac{5}{8}$ " x 2".

There will be on each end—

2 cleats  $14\frac{1}{4}$ " long

2 " 12" " (16" minus 4" width of 2 cleats.)

First determine the lineal inches of cleats.

Double the cleats for the two ends and accumulate over Fixed Decimal.

$$\begin{array}{r} 14\frac{1}{4} \times 4 \\ 12 \times 4 \end{array} \quad 105 \text{ lineal inches, } \frac{5}{8} \text{ stock.}$$

The stock being  $\frac{5}{8}$ " increase it 50% by multiplying by .5, or adding one-half to itself.....157.5 equivalent of lineal inches of  $\frac{3}{8}$ " stock.

**Find the square inches and reduce to feet.**

Leave this in the machine and multiply by 2, (width of cleats) i. e., add 1575 to itself, equals .....315 sq. in.  
315 sq. in.  $\times .007$  (or divide by 144) equals .....2.2 ft.

**BOX FACTORY WORK—Continued**

Box Lumber figured on the basis of 1" thick.

**EXAMPLE:**

Box  $17\frac{5}{8} \times 14\frac{1}{2} \times 8$ , sides of  $\frac{3}{8}$ " stock.  
ends of  $\frac{1}{2}$ " stock.

SIDE  $\frac{3}{8}$ ".

They plan to rip 1" stock in half which, when dressed, makes twice the board feet in  $\frac{3}{8}$ " stock. Therefore figure the surface feet in one side and top only, which equals the board feet of 1" lumber required.

ENDS  $\frac{1}{2}$ ".

These are made from  $1\frac{1}{4}$ " lumber.

Figure the surface feet in one end and increase it by 25%. This gives the board feet for the two ends.

$$\begin{array}{r} 17\frac{5}{8} \times 14\frac{1}{2} \times 8'' \\ \text{Add for outside measure } \frac{1''}{1''} \\ \hline 18\frac{5}{8} \times 15\frac{1}{2} \times 8'' \end{array}$$

Figure the end first and increase it by 25%.

Use the Fixed Decimal and accumulate—

$$15\frac{1}{2} \times 8 = 124$$

Hold .25 keys and multiply by 124. moving towards the left, thus increasing it by 25% = 155.

Continue and accumulate further

$$\begin{array}{l} 8 \times 18.625 \\ 15.5 \times 18.625 \end{array}$$

593 sq. in.

Reduce to board feet by multiplying by .007=

$$\begin{array}{l} \dots\dots\dots 4.15 \text{ ft.} \\ \text{or dividing by 144} = \dots\dots\dots 4.12 \text{ ft.} \end{array}$$

**PAPER BOX FACTORY PROBLEM**

These problems run into fractions of an inch in sizes and are usually figured exact.

The efficiency is doubled by the use of a 12-column Comptometer because the entire area can be figured in one continuous operation without making a pencil figure.

**EXAMPLE:**

Box  $16\frac{5}{8} \times 14\frac{1}{8} \times 12\frac{5}{8}$

$$16\frac{5}{8} \times 12\frac{5}{8} = \text{surface one side}$$

$$14\frac{1}{8} \times 12\frac{5}{8} = \text{surface one end}$$

$$16\frac{5}{8} \times 14\frac{1}{8} = \text{surface one side}$$

doubled = the entire surface area in box.

**METHOD WITH 12-COLUMN COMPTOMETER**

On the left of keyboard      On the right of keyboard

add      16.625

add      12.625

14.125

14.125

2.      for allowance      1.      for allowance

Double      32.750

27.750

this am't      32.75

65.50

Leave all in the machine and multiply 27.75 by 65.5.

Hold the 65.5 for key position (keys 65.4

see page 39) multiplying toward the

right equals..... 1817.625 in.

Reduce to square feet by multiplying by

reciprocal .007 = 12.7 ft. or dividing by

144 equals ..... 12.6 ft.

**COOPERAGE**

The principal articles in the Cooperage line are:—

Hoops

Heads

Staves

**HOOPS**

Hoops are put up in coils with 10 coils, or hoops, to a bundle. They are usually sold in carload lots ranging from 50,000 to 75,000 per carload.

**EXAMPLE:**

37,480 5'6" Hoops @ \$8.85 per M. at Mill	\$331.70
26,470 6'9" " @ 9.37 " "	248.02
	<hr/>
	\$579.72

**HEADS**

Heads of various sizes,  $14\frac{1}{2}$ – $17\frac{1}{8}$ – $19\frac{1}{8}$ – $23\frac{1}{2}$ ", are put up in bundles, the number of set in each bundle varying according to size —

$17\frac{1}{8}$ " Flour Barrels contain 20 sets per bundle,

$19\frac{1}{8}$ " Sugar " " 15 " " "

**EXAMPLE:**

4650 set (310 bdls.) $19\frac{1}{8}$ " Heads @ $9\frac{7}{8}$ c	
per set . . . . .	\$459.19
4360 set (218 bdls.) $17\frac{1}{8}$ " Heads @ $8\frac{3}{4}$ c	
per set . . . . .	381.50
	<hr/>
	\$840.69

**STAVES**

The Staves are sold by the thousand.

In some instances, they are kiln dried and jointed and put up in measured bundles of 81" total width each, and may be priced by the bundle or thousand.

The thousand price is based on  $4\frac{1}{4}$ " or  $4\frac{1}{2}$ " width, according to the length of the staves. A shipment, however, may contain staves from 2" to 6" wide, and the average width of the shipment must always be determined.

**EXAMPLE:**

1111 bdls. White Oak Kiln Dried and Jointed Staves,  
18 Staves per bundle,

$1111 \times 18 = 19,998$  Staves @ \$36.50 per M. \$729.93

or,

1111 bdls. @ \$.66 bdl.

$1111 \times 66 = 733.26$

**AVERAGE WIDTH OF STAVES**

They will take 100 staves at random, lay them side by side and measure the total width, then find the average; for example, 100 staves measure 38'6".

The average per stave is thus 4.62."

**SAP WOOD**

One eighth of an inch of sap wood is the maximum allowed the manufacturer in a whiskey barrel stave. If it contains more than that, the purchaser deducts same from the average width.

The following is a fair example of a Cooperage invoice:

MR. WILLIAM SMITH, Chicago, Ill.,						
BOUGHT OF						
UNITED STATES COOPERAGE COMPANY						
Jan. 27, 1913.						
Staves Ordered	Basis	Staves Furnished	Average	Equivalent of Basis	Price	Amount
24,500	4½"	24,890	4.62"	25,554	\$26.30 M.	\$672.07

#### METHOD No. 1

- 1st. Find the total width of 100 staves,  
equals 38'6", or ..... 462"
- Average per stave..... 4.62"
- 2nd. Find the number of 4.62" staves  
equivalent to 24,500  
4½".....  $24500 \times 4.50$   
4.62 = 23,863
- 3rd. The foreman ships 24,890 staves;  
therefore, find its equivalent in  
4½".....  $24890 \times 4.62$   
4.50 = 25,554
- 4th. 25,554 staves @ \$26.30 per M. = \$672.07

#### USE OF COOPERAGE TABLES

The work of determining the equivalent of a quantity of staves on any Basis is reduced to a single multiplication by the use of the Cooperage Tables on the following pages.

Determine the Equivalent of a quantity of Staves by merely multiplying the number of Staves by the corresponding percentage:  
From Table.

24,500 × .9740.....	23,863	Equivalent in Average Width of Staves Ordered.
24,890 × 1.0267.....	25,554	Equivalent in Basis Ordered of Quantity Furnished.
23,770 × 1.0044.....	23,875	Equivalent in Basis of Quantity Received.

#### CHECKING UP THE COOPERAGE SHIPMENT

- 1st. Find the average width of 100 staves = 4.62"
- 2nd. Measure and total the excess sap in each of the 100 staves —

In Eighths of an Inch					
2	2	2	2	3	1
2	2	2	2	2	2
3	1	1	1	2	2
3	1	1	3	2	3
1	3	2	2	2	2
1	2	1	1	1	
2	2	2	2	2	
1	2	2	1	2	
—	—	—	—	—	—

83

Equals a total of 83/8ths,

Or an average of .10" per stave.

Deduct this from the general average — 4.62"  
.10

Net average . . . . . 4.52"

Smith also finds 9 culls in a lot of 200 staves;  
which equals 4½%; therefore,

$24890 \times .04\frac{1}{2} = 1120$  culls

Total staves received 24890

Less culls 1120

Equals good staves 23770 averaging 4.52"

or  
 $24890 \times 95\frac{1}{2}\% = 23770$  good staves.

23,770 staves averaging 4.52" is equivalent to  
how many staves averaging 4.50"?

From the table on next page, 4.50 is 1.0044% of 4.52;

Therefore,  $23770 \times 1.0044 = 23875$  4½" staves.

23875 @ \$26.30 per M. = \$627.91

Less 36300 lbs. Freight @ 16½¢ per Cwt. 59.90

Smith claims as correct amount of Invoice . \$568.01

## COOPERAGE TABLE

Bold Face Figures represent the Percentage of Basis to Average. Light Face Figures represent the Percentage of Average to Basis.

Average	BASIS		Average	BASIS		Average	BASIS		Average	BASIS		Average	BASIS	
	4¼"	4½"		4¼"	4½"		4¼"	4½"		4¼"	4½"		4¼"	4½"
3.00	1.4167 .7059	1.5000 .6667	3.50	1.2143 .8235	1.2857 .7778	4.00	1.0625 .9412	1.1250 .8889	4.50	.9444 1.0585	1.0000 1.0000	5.00	.8500 1.1765	.9000 1.1111
3.01	1.4120 .7082	1.4950 .6689	3.51	1.2108 .8259	1.2821 .7800	4.01	1.0599 .9435	1.1222 .8911	4.51	.9423 1.0612	.9978 1.0022	5.01	.8483 1.1788	.8981 1.1133
3.02	1.4073 .7106	1.4901 .6711	3.52	1.2074 .8282	1.2874 .7822	4.02	1.0572 .9459	1.1194 .8933	4.52	.9403 1.0635	.9956 1.0044	5.02	.8466 1.1812	.8964 1.1156
3.03	1.4028 .7129	1.4851 .6733	3.53	1.2040 .8306	1.2748 .7844	4.03	1.0546 .9482	1.1166 .8956	4.53	.9382 1.0659	.9934 1.0067	5.03	.8449 1.1835	.8946 1.1178
3.04	1.3980 .7153	1.4803 .6756	3.54	1.2006 .8329	1.2712 .7867	4.04	1.0520 .9506	1.1139 .8978	4.54	.9361 1.0682	.9912 1.0089	5.04	.8433 1.1859	.8929 1.1200
3.05	1.3934 .7176	1.4754 .6778	3.55	1.1972 .8353	1.2676 .7889	4.05	1.0494 .9529	1.1111 .9000	4.55	.9341 1.0706	.9890 1.0111	5.05	.8416 1.1882	.8911 1.1222
3.06	1.3889 .7200	1.4706 .6800	3.56	1.1938 .8376	1.2640 .7911	4.06	1.0468 .9553	1.1084 .9022	4.56	.9320 1.0729	.9868 1.0133	5.06	.8399 1.1906	.8893 1.1244
3.07	1.3844 .7224	1.4658 .6822	3.57	1.1905 .8400	1.2605 .7933	4.07	1.0442 .9576	1.1057 .9044	4.57	.9300 1.0753	.9847 1.0156	5.07	.8383 1.1929	.8876 1.1267
3.08	1.3799 .7247	1.4610 .6844	3.58	1.1872 .8424	1.2570 .7956	4.08	1.0417 .9600	1.1029 .9067	4.58	.9279 1.0776	.9825 1.0178	5.08	.8366 1.1953	.8858 1.1289
3.09	1.3754 .7271	1.4563 .6867	3.59	1.1838 .8447	1.2535 .7978	4.09	1.0391 .9624	1.1002 .9089	4.59	.9259 1.0800	.9804 1.0200	5.09	.8350 1.1976	.8841 1.1311
3.10	1.3710 .7294	1.4516 .6889	3.60	1.1806 .8471	1.2500 .8000	4.10	1.0366 .9647	1.0976 .9111	4.60	.9239 1.0824	.9783 1.0222	5.10	.8333 1.2000	.8824 1.1333
3.11	1.3666 .7318	1.4469 .6911	3.61	1.1773 .8494	1.2465 .8022	4.11	1.0341 .9671	1.0949 .9133	4.61	.9219 1.0847	.9761 1.0244	5.11	.8317 1.2024	.8806 1.1356
3.12	1.3622 .7341	1.4423 .6933	3.62	1.1740 .8518	1.2431 .8044	4.12	1.0316 .9694	1.0922 .9156	4.62	.9199 1.0871	.9740 1.0267	5.12	.8301 1.2047	.8789 1.1378
3.13	1.3578 .7365	1.4377 .6956	3.63	1.1708 .8541	1.2397 .8067	4.13	1.0291 .9718	1.0896 .9178	4.63	.9177 1.0894	.9719 1.0289	5.13	.8285 1.2071	.8773 1.1400
3.14	1.3535 .7388	1.4331 .6978	3.64	1.1676 .8565	1.2363 .8089	4.14	1.0266 .9741	1.0870 .9200	4.64	.9159 1.0918	.9698 1.0311	5.14	.8268 1.2094	.8755 1.1422
3.15	1.3492 .7412	1.4286 .7000	3.65	1.1644 .8588	1.2329 .8111	4.15	1.0241 .9765	1.0843 .9222	4.65	.9140 1.0941	.9677 1.0333	5.15	.8252 1.2118	.8738 1.1444
3.16	1.3449 .7435	1.4240 .7022	3.66	1.1612 .8612	1.2295 .8133	4.16	1.0216 .9788	1.0817 .9244	4.66	.9120 1.0965	.9657 1.0356	5.16	.8236 1.2141	.8721 1.1476
3.17	1.3407 .7459	1.4196 .7044	3.67	1.1580 .8635	1.2262 .8156	4.17	1.0192 .9812	1.0791 .9267	4.67	.9101 1.0988	.9636 1.0378	5.17	.8221 1.2165	.8704 1.1489
3.18	1.3365 .7482	1.4151 .7067	3.68	1.1549 .8659	1.2228 .8178	4.18	1.0167 .9835	1.0766 .9289	4.68	.9081 1.1012	.9615 1.0400	5.18	.8205 1.2188	.8687 1.1511
3.19	1.3323 .7506	1.4107 .7089	3.69	1.1518 .8682	1.2195 .8200	4.19	1.0143 .9859	1.0740 .9311	4.69	.9062 1.1035	.9595 1.0422	5.19	.8189 1.2212	.8671 1.1533
3.20	1.3281 .7529	1.4063 .7111	3.70	1.1486 .8706	1.2162 .8222	4.20	1.0120 .9882	1.0714 .9333	4.70	.9043 1.1059	.9574 1.0444	5.20	.8173 1.2235	.8654 1.1556
3.21	1.3240 .7553	1.4019 .7133	3.71	1.1456 .8729	1.2129 .8244	4.21	1.0095 .9906	1.0689 .9356	4.71	.9023 1.1082	.9554 1.0467	5.21	.8157 1.2259	.8637 1.1578
3.22	1.3199 .7576	1.3975 .7156	3.72	1.1425 .8753	1.2097 .8267	4.22	1.0071 .9929	1.0664 .9378	4.72	.9004 1.1106	.9534 1.0489	5.22	.8142 1.2282	.8621 1.1600
3.23	1.3158 .7600	1.3932 .7178	3.73	1.1394 .8776	1.2064 .8289	4.23	1.0047 .9953	1.0638 .9400	4.73	.8985 1.1129	.9514 1.0511	5.23	.8126 1.2306	.8604 1.1622



COOPERAGE TABLE—Continued

3.24	1.3117 .7624	1.3389 .7200	3.74	1.1364 .8800	1.2032 .8311	4.24	1.0024 .9976	1.0613 .9422	4.74	.8968 1.1153	.9494 1.0533	5.24	.8111 1.2329	.8588 1.1644
3.25	1.3077 .7647	1.3346 .7222	3.75	1.1333 .8824	1.2000 .8333	4.25	1.0000 1.0000	1.0588 .9444	4.75	.8947 1.1176	.9474 1.0556	5.25	.8095 1.2353	.8571 1.1667
3.26	1.3037 .7671	1.3304 .7244	3.76	1.1303 .8847	1.1968 .8356	4.26	.9977 1.0024	1.0563 .9467	4.76	.8939 1.1200	.9454 1.0578	5.26	.8080 1.2376	.8555 1.1689
3.27	1.2997 .7694	1.3261 .7267	3.77	1.1273 .8871	1.1936 .8378	4.27	.9953 1.0047	1.0539 .9489	4.77	.8910 1.1224	.9434 1.0600	5.27	.8065 1.2400	.8539 1.1711
3.28	1.2957 .7718	1.3219 .7289	3.78	1.1243 .8894	1.1905 .8400	4.28	.9930 1.0071	1.0514 9511	4.78	.8891 1.1247	.9414 1.0622	5.28	.8049 1.2424	.8523 1.1733
3.29	1.2918 .7728	1.3178 .7311	3.79	1.1214 .8918	1.1873 .8422	4.29	.9907 1.0094	1.0490 9533	4.79	.8873 1.1271	.9395 1.0644	5.29	.8034 1.2447	.8507 1.1756
3.30	1.2879 .7741	1.3136 .7333	3.80	1.1184 .8941	1.1842 .8444	4.30	.9884 1.0118	1.0465 9556	4.80	.8854 1.1294	.9375 1.0667	5.30	.8019 1.2471	.8491 1.1778
3.31	1.2840 .7788	1.3095 .7356	3.81	1.1155 .8965	1.1811 .8467	4.31	.9861 1.0141	1.0441 9578	4.81	.8836 1.1318	.9356 1.0689	5.31	.8004 1.2494	.8475 1.1800
3.32	1.2801 .7812	1.3054 .7378	3.82	1.1126 .8988	1.1780 .8489	4.32	.9838 1.0165	1.0417 9600	4.82	.8817 1.1341	.9336 1.0711	5.32	.7989 1.2518	.8459 1.1822
3.33	1.2763 .7835	1.3014 .7400	3.83	1.1097 .9012	1.1750 .8511	4.33	.9815 1.0188	1.0393 9622	4.83	.8799 1.1365	.9317 1.0733	5.33	.7974 1.2541	.8443 1.1844
3.34	1.2725 .7859	1.3473 .7422	3.84	1.1068 .9035	1.1719 .8533	4.34	.9793 1.0212	1.0369 9644	4.84	.8781 1.1388	.9298 1.0756	5.34	.7959 1.2565	.8427 1.1867
3.35	1.2687 .7882	1.3433 .7444	3.85	1.1039 .9059	1.1688 .8556	4.35	.9770 1.0235	1.0345 9667	4.85	.8763 1.1412	.9278 1.0778	5.35	.7944 1.2588	.8411 1.1889
3.36	1.2649 .7906	1.3393 .7467	3.86	1.1010 .9082	1.1658 .8578	4.36	.9748 1.0259	1.0321 9689	4.86	.8745 1.1435	.9259 1.0800	5.36	.7929 1.2612	.8396 1.1911
3.37	1.2611 .7929	1.3353 .7489	3.87	1.0982 .9106	1.1628 .8600	4.37	.9725 1.0282	1.0297 9711	4.87	.8727 1.1459	.9240 1.0822	5.37	.7914 1.2635	.8380 1.1933
3.38	1.2574 .7953	1.3314 .7511	3.88	1.0954 .9129	1.1598 .8622	4.38	.9703 1.0306	1.0274 9733	4.88	.8709 1.1482	.9221 1.0844	5.38	.7900 1.2659	.8364 1.1956
3.39	1.2537 .7976	1.3274 .7533	3.89	1.0925 .9153	1.1568 .8644	4.39	.9681 1.0329	1.0251 9756	4.89	.8691 1.1506	.9202 1.0867	5.39	.7885 1.2682	.8349 1.1978
3.40	1.2500 .8000	1.3235 .7556	3.90	1.0897 .9176	1.1538 .8667	4.40	.9659 1.0353	1.0237 9778	4.90	.8673 1.1529	.9184 1.0889	5.40	.7870 1.2706	.8333 1.2000
3.41	1.2463 .8024	1.3196 .7578	3.91	1.0870 .9200	1.1509 .8689	4.41	.9637 1.0376	1.0204 9800	4.91	.8656 1.1553	.9165 1.0911	5.41	.7856 1.2729	.8318 1.2022
3.42	1.2427 .8047	1.3158 .7600	3.92	1.0842 .9224	1.1480 .8711	4.42	.9615 1.0400	1.0181 9822	4.92	.8638 1.1576	.9146 1.0933	5.42	.7841 1.2753	.8303 1.2044
3.43	1.2391 .8071	1.3120 .7622	3.93	1.0814 .9247	1.1450 .8733	4.43	.9594 1.0424	1.0158 9844	4.93	.8621 1.1600	.9128 1.0956	5.43	.7827 1.2776	.8287 1.2067
3.44	1.2355 .8094	1.3081 .7644	3.94	1.0787 .9271	1.1421 .8756	4.44	.9572 1.0447	1.0135 9867	4.94	.8603 1.1624	.9109 1.0978	5.44	.7813 1.2800	.8272 1.2089
3.45	1.2319 .8118	1.3043 .7667	3.95	1.0759 .9294	1.1392 .8778	4.45	.9551 1.0471	1.0112 9889	4.95	.8586 1.1647	.9091 1.1000	5.45	.7798 1.2824	.8257 1.2111
3.46	1.2283 .8141	1.3006 .7689	3.96	1.0732 .9318	1.1364 .8800	4.46	.9529 1.0494	1.0090 9911	4.96	.8569 1.1671	.9073 1.1022	5.46	.7784 1.2847	.8243 1.2133
3.47	1.2248 .8165	1.2968 .7711	3.97	1.0705 .9341	1.1336 .8822	4.47	.9506 1.0518	1.0067 9933	4.97	.8551 1.1694	.9054 1.1044	5.47	.7770 1.2871	.8227 1.2156
3.48	1.2213 .8188	1.2931 .7733	3.98	1.0678 .9365	1.1307 .8844	4.48	.9487 1.0541	1.0045 9956	4.98	.8534 1.1718	.9036 1.1067	5.48	.7755 1.2894	.8212 1.2178
3.49	1.2178 .8212	1.2894 .7756	3.99	1.0652 .9388	1.1278 .8866	4.49	.9465 1.0565	1.0022 9978	4.99	.8517 1.1741	.9018 1.1089	5.49	.7741 1.2918	.8197 1.2200

AUDIT OFFICE OF JORDAN-MARSH & COMPANY, BOSTON, MASS.

# **DEPARTMENT STORES**

## DEPARTMENT STORES

All Department Stores, from the smallest to the largest, have splendid use for the Comptometers.

The accuracy and efficiency effected by their introduction inspires proprietors, managers and employees alike with a higher respect for the Comptometer. It will justify all that can be said for it as the greatest mental labor-saving device on the market. Frequently the saving effected the first year will be greater than the cost of the machines installed.

The smaller Department Stores, having only a few hundred sales checks daily, as well as the largest, that may have as high as 200,000, are using Comptometers for auditing cash and charge sales checks.

In auditing, the adding and the balancing of the sales checks is reduced to the least possible effort and action. This work is considered one of the most important in the office of a Department Store.

The operator adds the Sales Checks with the attention continuously given to turning the checks and reading the amounts.

These amounts are transferred from the checks to the finger tips by sight and added almost unconsciously. After some continuous use, the operator will complete twice as much work with the Comptometer as is possible with any other method.

The smaller department store finds the Comptometer of greater comparative value because:—

The **saving and accuracy** means so much more on a small volume of business;

The **accuracy is assured** in proving the **extensions and footings** of purchase invoices;

Also, in figuring percentages, working up statistical data, payrolls, etc.

In the **auditing of cash and charge checks** a double benefit is derived from the time saved, i. e., the Comptometer enabling work which formerly required two hours to be done in one hour affords the additional employment of that hour on other work.

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## **DEPARTMENT STORE USES**

The principal uses for Comptometers in Department Stores are:—

### **Bookkeeping Department:**

(For Bookkeeping and Cashiers' Work, see index.)

Proving Extensions on Sales Checks,

Proving Daily Postings,

Addition of Ledger Balance,

Totaling Debits and Credits,

Obtaining Debit and Credit Balances of Accounts,

Taking Off Trial Balance With the Comptometer

Sub-Total Method,

Totaling the Outgoing Invoices.

### **Cashier's Department:**

Addition of Deposit Slips,

Addition of Cash Book,

Addition of Remittance Letters,

Addition of Bank Checks,

Making Up Payrolls.

### **Purchase Department:**

(For Purchase Department Work see index.)

Proving Cost Extensions and Additions on Incoming Invoices,

Computing Selling Extensions and Additions on Incoming Invoices,

Computing Percentages of Profit on Incoming Invoices,

Totaling Purchases by Departments,

Computing American Values on Foreign Monies.

### **Billing and Statement:**

Proving Charge Extensions and Footings,

Footings and Proving Statements.

### **Auditing:**

Adding Sales Checks. (These Sales Checks may consist of "Charge Sales," "Cash Sales," or "C.O.D.'s" and "Will Calls.")

Balancing by Cashiers,

Balancing by Departments,

Balancing by Clerks,

Adding Charge Sales by Ledgers for Verifying Ledger Totals,

Vertical and Cross-Footings on Recap. Slips, Sheets or Sales Records,

Adding Summaries of Clerks' Sales.

### **Statistical:**

Computing Clerks' Percentages of Salary Based on Sales,

Figuring, Adding and Proving Inventories,

Computing Percentages of Increase or Decrease of Purchases,

Computing Sales and Stocks by Departments.

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**AUDITING THE SALES****OBJECTS OF AUDITING**

- A Ready and Accurate Account of Money Received;**
- A Record of the Amount of Sales of Each Clerk;**
- A Record of the Amount of Sales of Each Department;**
- To Retain all Sales Checks Intact;**
- To Locate any Missing Checks in the Easiest and Quickest Possible Manner;**
- To Reveal any Irregularity on the Part of a Sales Person.**

**Adding Sales Checks**

The adoption of the Comptometer has reduced auditing forces  
from— 35 to 17 clerks  
22 to 12 clerks  
17 to 14 clerks  
42 to 28 clerks

The further fact that it enables balancing to the cent proves its value on this work.

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## METHOD OF HANDLING THE AUDIT

### BALANCING CASHIERS

The bundle of checks from each Cashier is totaled separately and the amount is written on the back of the last check.

The Auditor then compares each Cashier's Total Cash with the Audit Total.

If the Cashier is out of balance, the Audit Total is re-added for absolute proof.

### THE CLERKS' SALES

The checks are sorted into clerks' numbers and each clerk's checks are added and the total entered on a sheet under the proper department and opposite the respective clerk number.

The Total is proven against the total of the Summary in the Clerks' Sales Book.

In proving thus, it assures —

Against missing checks,

Against mis-sorted checks,

Against checks altered by cashiers.

### DEPARTMENT SALES

The department columns are totaled on the above sheet and cross-footed to prove. The Grand Total is proven against the Total of all the Cashiers.

### BOOKKEEPING

As the postings are made, Comptometer Debit and Credit Markers are dropped in the Ledger, then with the Comptometer placed right beside the work, the amount of each posting is added and proves against the total of the bundle posted.

The total of the bundle posted is then compared with the Audit Totals and thus a perfect daily balance is assured.

The other Bookkeeping work, such as —

Balancing Ledger Accounts,

Taking Off Trial Balances, etc.,

is treated under corresponding subjects under "Bookkeeping."

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## DEPARTMENT STOCK

Many of the large department stores work up a monthly Department Stock Record. This is done to keep in touch with the condition in each department and for a check against the buyer in maintaining his profit as figured on invoices.

### DEPARTMENT STOCK RECORD

LACE DEPARTMENT											
	Cost	Retail	Marked Profit	Marked %	Marked Downs	Retail Less Marked Downs	Profit Less Marked Downs	Reduced %	Sales	STOCK	
										Cost	Retail
On Hand	1465	2197	732	3333							
Purch	677	1117	445	3994							
Total	2137	3314	1177	3557	117	3197	1060	3315	631	1715.37	2566.00

Use the larger Comptometer and the Fixed Decimal. This brings the Dividend in the register, where you can proceed with the division, carrying out decimally as far as necessary.

Add the "Retail" in the Fixed Decimal

position.....\$2197.00

Deduct the "Cost"..... 1465.00

Equals the "Marked Profit"..... \$732.00

Divide this by the "Retail," 2197

Equals "Marked Per Cent" ..... .3333

Proceed in the same manner with the "Purchase" and the "Total to Date" Per Cents.

#### "MARKED DOWN"

Deduct the "Marked Down" from the

"Retail" .....\$3314.00  
117.00

Equals the "Net Retail" .....\$3197.00

Also deduct the "Marked Down" from

the "Marked Profit" ..... 1177.00  
117.00

Equals the "Net Marked Profit" ....\$1060.00

Divide the net "Marked Profit" by the net "Retail"  $1060 \div 3197 = .3315$ , the "Reduced Per Cent"

#### STOCK ON HAND

To find the value of stock on hand—

Deduct from the "Net Retail" ...\$3197.00

The amount of Sales..... 631.00

Equals the "Present Retail" .....\$2566.00

Multiply this "Retail" by the  
net of the "Reduced Per Cent"

$(100 - 3315) \dots\dots\dots .6685$

\$1715.37 Cost

.3315 being the Per Cent of Profit, the net,  
.6685, must be the Cost.

The ten or twelve column Comptometer, especially the latter, makes possible "short cuts" that facilitate the speed, ease and accuracy. These double operations are appreciated only after using the larger Comptometers on this class of work.



## PURCHASE DEPARTMENT

Many Purchase Departments figure the estimated per cent of profit as marked on each item of the purchase invoice.

## EXAMPLE:

## WANTED:

- The Per Cent of Profit on each item, based on the selling price;
- The total Marked Profit on Invoice;
- The Average Marked Per Cent Profit.

## FIGURING THE PER CENT OF MARKED PROFIT

Add the selling price in the machine, using  
 the Fixed Decimal . . . . . \$6.00  
 Subtract out the cost . . . . . 3.25  
 Dividing this by the selling price, \$6.00 ) 2.75  
 Equals the per cent of marked profit . . .458

The Register shows .458—2 Remainder.

Prove the division by holding the Quotient Keys directly over itself and multiplying the Divisor, adding in the Remainder.

## METHOD

## Prove Original Extensions:

Use the Fixed Decimal;

Accumulate the original extensions to the total—\$56.75.

## Make Selling Extensions:

Make extensions of quantities by the selling prices separately.

Add the total of selling extensions in the Fixed Decimal position . . . . . \$101.30  
 (This will leave the amount of Marked Profit in the machine, where the division can be carried out decimally as far as necessary.)

Deduct the total amount of invoice . . . . . 56.75  
 Equals the marked profit . . . . . \$ 44.55

Divide this by the total of the selling price, 101.30, equals the average Marked Profit on the invoice . . . . . 44%  
 (.439—Remainder 793,— as 44%)

## PROVING THE DIVISION

With the larger Comptometer, merely hold the Quotient Keys directly over itself and multiply by the Divisor, multiplying towards the left. (One less stroke for the right hand figure, as the multiplier is already in the machine once.)

Then add in the Remainder, which is still showing in the Register.

With the smaller Comptometer, subtract out the Quotient. Then, starting directly over the remainder, 793, multiply the Quotient, 439, by the Divisor, 101.3, equals the Dividend, 44.55.

## PROOF SLIPS

Many firms attach to each invoice a Proof Slip bearing the Invoice number, the Department and the Amount.

The items of—

Selling Price,  
Cost,  
Profit,  
and Per Cents

are entered on the Proof Slip as figured.

Shipper <i>James Todd &amp; Co</i>		Date Received <i>3/11/13</i>	No <i>5786</i>
Address _____		Memo _____	
Received by <i>Casey</i>	<div style="border: 1px solid black; padding: 5px; text-align: center;"> DEPT. <i>R</i> </div>	Terms <i>1/10/60</i> Due _____	Date _____
Quantity Checked <i>CS</i>		Amount of Invoice _____	\$ <i>347.85</i>
Department Checker <i>S. S.</i>		Deductions _____	
Buyer <i>S. S.</i>		Returns _____	
Requisitions Compared		Freight _____	
By <i>Frank</i>		Claims _____	
Extensions Checked <i>Casey</i>		Discount _____	
Figuring S. P. <i>581.35</i>		Net Amount of Invoice <i>347.85</i>	
% Profit <i>41%</i>	Net Profit <i>\$738.50</i>	Approved by <i>W. H. R.</i>	

### THE WEEKLY MERCHANDISE REPORT

The Weekly Merchandise Report shows the value of the goods that should be in each department at the end of each week.

WEEKLY MDSE REPORT										WEEK- June 15-12	
DEPT.	MDSE. FORW'D			PUR.	NET COST		ACTUAL	INV on	MDSE +	UNFIL'D	Advan.
	1910	1911	1912		SALES	TRANS.					
1	4760	5346	5816	275	280	14	5797	325	6122	750	150
2											
3											
4											
DEPT PURCHASES ARE TAKEN FROM											
LEDGER CHARGES											

The Comptometer Operations are —

Add the Merchandise..... 5816  
and the Purchases..... 275  
6091

Deduct the Net Sales and Transfers..... 294

Equals the Actual Merchandise..... 5797

Add the Invoices on file..... 325

Equals Total Stock & Goods Invoiced.... 6122

### WEEKLY EXPENSE REPORT

The following Weekly Expense Report is made up by departments.

Its object is, first, to ascertain the percentage of each element of cost to the Weekly Sales.

Second, the percentage of the "Cost To Date" of each element to the "Sales To Date."

WEEKLY EXPENSE REPORT												WEEK- June 15-12			
DEPT.	SALES WK	SALES TL	LAB. WK	%	LAB. TL	%	ADV. WK	%	ADV. TL	%	EXP. WK	%	DISC. WK	%	
1	1213	2762	78 65	.065	157 32	.057	18 00	.015	29 60	.011	25 00	.021	3 75	.003	
2	250	534	17 42	.07	32 46	.061	1 50	.006	2 50	.005	1 00	.004			
3	423	769	39 56	.094	76 41	.099	2 95	.007	5 50	.007	12 00	.028			
4	406	801	25 00	.062	58 00	.072	3 95	.010	7 25	.009	3 75	.009	1 90	.005	
5	1876	3746	98 40	.053	216 74	.058	29 75	.016	70 60	.019	38 00	.02	15 80	.008	
6	1342	2972	340 25	.254	751 62	.253	5 90	.004	11 25	.004	125 00	.093			
7	659	1134	78 15	.119	168 45	.149	3 25	.005	8 30	.007	18 50	.028	2 75	.004	
GEN.			875 50	.142	1927 65	.152	243 60	.04	427 65	.034	375 60	.061			
	6169	12718	1552 93		3388 65		308 90		562 65		598 85		24 20	.004	

#### METHOD

Add the various columns of items.

Figure the percentages by division or use of the Comptometer Reciprocal Table.

#### DIVISION

In most of the percents it is apparent at a glance that there will be only two figures in the answer, and

only the first three figures of the Divisor need be used.

#### RECIPROCAL

If using the "Reciprocal Table," the same rule will apply. It is, therefore, necessary to use only the first three figures of the reciprocal.

**"PURCHASE POSSIBLE" REPORT**

Many department stores make up a "Weekly Purchase Possible" Report for the Manager or buyer of each department.

The "Purchase Possible" for a department is usually an amount equal to the "Net Sales" of the previous year's season, (6 mos.)

If the Inventory were less than an established basic minimum, the Purchase Power would be correspondingly more, while, on the other hand, if the Inventory were greater than the Basic Minimum, the Purchase Power would be that much less.

Again,—the Purchase Power is increased or decreased each week by the amount of sales greater or less than the same period of the previous year.

**METHOD**

78750	Net Sales for last year's season, (6 mos.)
2500	Inventory under minimum
81250	Purchase Possible for the Season stocked
7025	Total Purchases—Merchandise stocked 500
	Invoices on File....3750
	Unfilled Orders...2775
	<u>7025</u>
74225	Purchase Possible at End of 1st Week.

## STATISTICAL DATA

A large amount of Statistical Data is usually required.

## COST OF SALES FORCE

A record is kept of the sales of each clerk in order that a percentage of salary to sales may be determined weekly. This furnishes concrete data as to the efficiency of clerks and is an aid in determining and eliminating the inefficient clerks or in correcting and improving the qualities desirable in the sales person.

EXAMPLE:

SMITH 1912		.033% Last Season No 184			
DATE	WEEK SALES	SALES TO DATE	LABOR	WEEK %	AVGE %
4-8	2530				
9	3753				
10	2975				
11	1840				
12	4527				
13	6150				
	21775		645	.03	
		218.			.03
4-15	3372				
16	4165				
17	1850				
18	2264				
19	5270				
20	8432				
	25353	254.	724	.028	
		472.	1369		.029

Add the Weeks Sales for each clerk

Add Sales to date

Figure % for Selling Cost

Figure % for Avge. Selling Cost

## COMPARATIVE LABOR REPORT

This is a weekly report showing by departments the cost of the actual Selling Labor and "Dead Labor." The latter would be such as cleaning up the department, rearrangement of store, etc.

The percentage of the Total Selling Cost to the Sales is obtained for a comparison with previous years.

## Labor and Sales taken from Pay Roll and Sales Books

The sales for the Departments and against which the above percentages are figured are as follows:

Depts.	40	41	42	43	44
	\$332	\$1943	\$1577	\$442	\$139
Depts.	45	46	47	48	
	\$2647	\$2162	\$204	\$3155	

% for 2 Previous Years is Copied

Figure % per Department for Current Week

Add the items of "Dead Labor," "Sales Labor" and "Total Labor."

Figure Percentage on the Totals.

### WEEKLY RECAP. OF CLERKS' SALES

Sales Distribution Sheets are made up in several ways. The following is a fair sample. It shows a distribution of Cash and Charge Sales by Departments and clerks. The Cash and Charge Sales are on separate lines, so that the total of each is obtained by cross-footing.

DATE		JONES	THOMAS	ELLIS	DEPP	OTIS	TOTAL CASH	DEP'T. No.15	
		*151	*152	*153	*154	*155		TOTAL CHARGES	GRAND TOTAL
1912									
6/3	CASH	47 28	67 81	15 83	18 40	9 85	159 17		
	CHG.	15 65	28 94	39 48		29 60		113 67	272 84
4	CASH	39 43	54 65	28 51	15 64		138 23		
	CHG.	18 27	9 68	13 97	23 70			65 62	203 85
5	CASH	27 61	49 33	31 50		24 75	133 19		
	CHG.	12 75	14 78			8 54		36 07	169 26
6	CASH	34 71	42 60	29 72	24 75	33 78	165 56		
	CHG.	15 24	21 52	12 50	21 60	16 40		87 26	252 82
7	CASH	78 69	107 62	54 70	56 90		297 91		
	CHG.	37 80	54 75	23 65	31 72			147 92	445 83
8	CASH	127 89	148 65	88 72	81 40	174 69	621 35		
	CHG.	57 65	74 63	29 65	37 52	78 81		278 26	899 61
TOTAL		512 97	674 96	368 23	311 63	376 42	1515 41	728 80	2244 21

#### METHOD

Cross-add the Cash Sales .....	159.17
Clear the machine and cross-add the Charge Sales .....	113.67
Leave this in the machine and add to it the Total Cash Sales .....	159.17
	<u>272.84</u>

Add the sales for each department, (vertical columns).

Cross-add these totals and balance against the footing of "Grand Total" column.

## FIGURING DEPARTMENT PERCENTAGES BY THE RECIPROCAL AND WITH THE FIXED DECIMAL

The Salesmen's Analysis Sheet offers a good opportunity for use of the Reciprocal Table.

The percentage of profit has to be figured in each department, based on the Selling Price. When the cents amount to 50 or more they are treated as \$1.00; under 50 cents disregarded.

U. S. WHOLESALE DRY GOODS CO.										SALESMEN'S ANALYSIS SHEET															
DEPTS.		A			B			C			D			E											
SALESMAN	SALES	PROFIT	%	SALES	PROFIT	%	SALES	PROFIT	%	SALES	PROFIT	%	SALES	PROFIT	%										
John Jones	136	47	27.84	205	34	12.6	96	27	28	62	28.8	672	16	11.4	26	17.0	274	23	62	70					
Wm. Salton	247	62	52.73	213	41	6	28	116	27	28	45	70	16	24	35.3	832	48	2.03	75	24.5	328	46	86	32	
H. O. Oppen	92	28	14	16	15.4	185	26	32	46	17.5	26	28	3	62	13.9	324	85	38	45	11.8	142	60	2	132	
Jan. A. Myers	234	60	67	82	28.9	627	34	196	26	31.3	242	37	76	24	31.5	1246	32	31.6	74	25.4	249	16	42	76	
Wm. A. Palmer	32				14.7	324	37				95	40	24	6	324						7	32	1	52	
Oran Harper																									

### METHOD

In working up the above Analysis Sheet, you see at a glance that practically all of the Department Sales are under \$1,000.00, or within the limits of the Reciprocal Table. You can, therefore, use the Fixed Decimal method.

Hold the Reciprocal with the Decimal the same as shown on the Reciprocal Table and point off three places to the left for the actual Decimal in the percents.

1ST PER CENT: The Reciprocal for 136.0 is 7.353 to multiply 27.84.

Hold the 7.3 keys, (first finger of each hand) move to the left one place and multiply 27.84, moving to the right.

After multiplying the last figure, 4, shift the fingers to 53 in the next two columns on the right and work back with same, = .205. (This is the simplest manner of using Split Multipliers.)

2ND PER CENT: The Reciprocal for 248 is 4.032.

Hold the Reciprocal over the Fixed Decimal, move to the left one place and multiply 52.73 = .213.

### ANOTHER METHOD OF TAKING FIXED DECIMAL KEY POSITION

The Unit Place of the Key Factor always occupies the column belonging to the figure you are multiplying.

You can, therefore, go direct to the keys representing the first Multiplier Position.

EXAMPLE: Reciprocal of 136 is 7.358 to be multiplied by 27.84.

In taking the first position on 7.3, 7 is the Unit Figure of the Key Factor, so take the key position directly on that key in the \$20 column and multiply toward the right.





## MANUFACTURERS OF CLOTHING, ETC.

In the manufacturing clothing business, the Comp-tometer is used extensively in the following departments:

### BOOKKEEPING

Balancing Individual Accounts.  
Proving Daily Postings.  
Drawing off Trial Balance.  
Miscellaneous footings and subtractions on all books.

### CASHIERS

Footings and Subtractions in proving accuracy of Check Book Stubs, Cash Books, etc.

### ACCOUNTING

Figuring all Outgoing Sales Invoices, as to extensions and footings.

Proving Incoming Invoices and Discounts on Goods Purchased.

Proving Cash Sales, Tickets and Credit Memo's.

Proving all footings and extensions on Invoice Books, Purchase Ledgers, Freight Accounts, Salesmen's Records and Commissions.

### STATISTICAL

On footings, figuring extensions and figuring percentages found in the following:

Sales Reports — total Sales by classification — Department and salesman.

Sales Cost Reports — by classification — Department and salesman, giving percentages compared with previous months, etc.

General Expense Reports by Departmental distribution.

Profit and Loss Statements — Gross and Net from operations.

Various other Shop or Departmental Summaries and Statistics.

### PAYROLL

Figuring and checking all Payrolls.

In the manufacturing end, or shop payrolls, there are three classes — Contract Work, Time Work and Piece Work.

Many firms contract with other Houses to have their Coats, Vests and Pants made at a flat rate per garment. The firm does the cutting, furnishes all findings and trimmings and sends them to the contractor. It is then necessary to figure the number of garments made during the week from their records and multiply by the rate.

Firms operating their own shops pay the workers a weekly salary with gradations for the different classes of help. The Cutters' week is usually 48, 50 or 52 hours.

Each man is paid for the hours he works. Many firms put both the hourly and weekly rate on the time card, so that it requires only one multiplication.

Firms operating on a piece work basis keep a record of the number of pieces turned in daily and give the operator a ticket showing same. At the end of the week, the Payroll is figured accumulatively from the Inspector's book,— such as:—

14 pieces — \$ .15

21 " .17

19 " .24 etc.

The operators' tickets are turned in. The Comp-tometer operator accumulates these extensions and compares with the Inspectors' books.

**USES—Continued****COST**

Figuring all manufacturing costs by lots and single garments.

Figuring weekly or monthly recapitulation of costs, giving percentages as compared with last month and year, etc.

Figuring costs of operation by departments.

There is a large amount of adding and detail figuring in all manufacturing of cloth goods.

**CUTTING TICKET**

In a general way, the data is treated as follows, the work being greatly facilitated by the aid of the Comptometer.

A Cutting Ticket is made out by the Stock Man for the Cutting Department. This contains data as to—

Style of Suits,  
Style of Goods,  
Yards of Cloth Turned Over,  
Number of Coats, Vests and Pants, and  
Details as to Sizes.

The Cutter's time is noted on Cutting Ticket. It is then turned over to the Trimmer.

Here a detailed account is kept of all the Trimming used in making the garments.

**TRIMMING COST TICKET**

Illustrated on the following page is a sample Trimming Cost Ticket. You will note that each item is figured separately and these results added for Total Cost of Trimmings for the Coats, Vests and Pants. This cost is divided by the number made of each article, to ascertain the unit cost.

The calculations are:

49 Fractional Extensions  
The Adding of 49 Items  
3 Divisions.

This sheet was figured, complete, on the Comptometer in **7 minutes**. The old mental method would take from one-half to three-quarters of an hour. .

If only the Total Cost of all the Trimming on the Coats, etc., is required, the work can easily be reduced one-half.

**METHOD**

Accumulate the extensions over the Fixed Decimal, arriving at the Total Cost of the Coats, Pants, etc., without writing down an intermediate result.

The latter method will eliminate the making of 114 figures on this sheet and also eliminates the adding of the three columns of 49 items.

Lot 1000

Lot 1002

Lot 1001

26

COATS Mens

26 VESTS.

28 PANTS.

Quantity	Price		
Lining			
Body Lining	25 1/2	1 25	44 68
Sleeve "	23 1/2	34	5 58
Interlining			
Canton Flannel			
Silesia	14 1/2	14 1/2	2 10
Canvas	27 1/2	23	6 33
Shoulder Canvas			
Cuff Lining			
Pade	26	05	1 30
Padding	10 1/2	30 1/2	3 82
Wadding	2 1/4	32 1/4	73
Wigan	5 1/4	07	23
Holland	3 1/4	18	59
Galloon			
Binding			
Buttons, large	75	1 15	60
" small	154	85	91
Machine Silk	4	50	2
Skein	40	0 1/2	60
B. H. Twist	21	02	45
Machine Cotton	4	03	12
Spool Thread	13	02	26
Skein	26	3/8	6
Stay Tape	125	1/4	31
Freig			
Muslin			
Velvet			
Hangers and Labels	26	1	13
Bulk Serge Face			
Pockets			
Cutting			
Making			
Collar Cloth	1	118	114
			72 01

Lining, back			
" inside	19 1/2	24	4 77
Silesia Lining			
" Back			
Pocket Silesia	5 1/4	14 1/2	76
Outside Back	18 1/2	125	17 97
Satin Back			
Wigan	14 1/2	07	1 01
Wadding			
Buckles	26	70	18
Buttons	130	90	82
Rings			
Binding			
Stay Binding	50	1/4	13
Holland			
Machine Silk	11 1/4	50	64
Skein	13	1 1/2	20
B. H. Twist	13	02	26
Machine Cotton	5	03	15
Beating Cotton	5	02	10
Spool Thread			
Skein	9	5/8	05

Lining			
Waist Lining	28	24	2 28
Canvas	2 1/2	11	26
Holland	1 1/2	19	21
Silesia	2 1/2	14 1/2	40
Jeans			
Suspender Buttons	168	100	77
Fly	140	04	47
Pocket	52	25	27
Binding			
Bottom Canvas Bind'g			
Pockets	21 1/2	14 1/2	3 03
Curtain			
French Fly			
Machine Silk	8	50	1 50
Skein	28	2 1/2	42
B. H. Twist			
Machine Cotton	1	03	03
Beating	14	02	28
Spool Thread			
Skein	20	7/8	13
Buckles	28	20	20
Taps			
Galloon			
Leather			
Web	28	3/4	21
Lappa			
Muslin			
Hooks	28	5/8	18

PRICES FOR MAKING

Coats 250 Vests 60 Pants 60

Suits 320

PRICES FOR TRIMMING

Coats 222 Vests 104 Pants 384 Suits 419

**CLOTHING—Continued**

Then a Recap. of all this data is made on a permanent Ledger Sheet, on which the unit cost of Cloth, Making, Trimming and Cutting is figured and entered. This is kept for the final record of each suit, overcoat, etc.

**RECAP. OF COST SHEET**

Lot No.	Yds.	Article	No. Made	Style	Cloth	Cost Cloth	Cost Each	Yds. Ea.
1000	39	Men's Coats	26	S. B. 3-Button	\$2.33 $\frac{1}{2}$	\$91.00	\$3.50	1 $\frac{1}{2}$
1001	35	" Pants	28	Plain Pattern	"	81.67	2.92	1 $\frac{1}{4}$
1002	10 $\frac{1}{4}$	" Vests	26	S. B. 5-Button	"	23.92	.92	$\frac{2}{5}$

**COST EACH**

COATS		PANTS		VESTS		TOTALS	FINAL
Cloth . . . . .	\$3.50	Cloth . . . . .	\$2.92	Cloth . . . . .	\$ .92	\$7.34	
Making . . . . .	2.50	Making . . . . .	.60	Making . . . . .	.60	3.70	
Trimming . . . . .	2.77	Trimming . . . . .	.38	Trimming . . . . .	1.04	4.19	
Cutting . . . . .	.15	Cutting . . . . .	13	Cutting . . . . .	.04	.32	
	\$8.92		\$4.03		\$2.60		\$15.55

**METHOD**

Divide the total yardage for each of the three articles by the number made—equals the yards each.

Multiply the yards by the price per yard. In this case, it is easy to hold the yardage keys. Then, multiply to the fourth place—equals the cost of the cloth.

Divide the cost of cloth by the number made of each article—equals the cost each.

Add the "item costs" of each article for the net cost.

Cross-add for item cost per suit.

Add these cross-totals for final cost of suit.

## THE COTTON INDUSTRY AT THE GINNING PLANT

The principal value of a Comptometer here is accuracy. The farmers bring in a load of cotton and are paid for the seed or cotton at the time; hence, the importance of positive accuracy.

In addition to the accuracy, the Comptometer saves considerable time and lightens the labor very much.

CUSTOM GINNING TICKET			
No. <u>1737</u>	Date <u>1-26</u>	191 <u>3</u>	
Ginned for <u>J. Jones</u>			
Gross Wt. <u>4800</u>	Our Bale No. _____		
Tare " <u>3160</u>	" Mark _____		
Net " <u>1640</u>	Customer's No. _____		
Bale " <u>600</u>	" Mark _____		
Seed Bought <u>1090 @ 24.00 = 13.28</u>			
Bale Bought <u>✓</u> @ _____ \$ _____			
Less Gin'g \$ _____	B & T \$ _____	Total \$ <u>1.00</u>	
Rebate, per Check No. _____		\$ <u>12.28</u>	
G & W Paid Cash \$ <u>Cash</u>	Charged \$ _____		
Seed Hauled Away <u>No</u>			
Bale Hauled Away <u>Yes</u>			
Bale Left, Owner's Risk of Fire, Deliverable } Only Upon Return of This Ticket..... }			
By <u>James</u>			
S. C. TOOF & CO. MEMPHIS 3645 10-9-11 FORM 70			

### METHOD 1

Add in the Gross.....	4800
Subtract out the Tare.....	3160
Net.....	1640

They allow 66 $\frac{2}{3}$ % of the net for the quantity of seed.

Multiply 1640  $\times$  .6667  
(and take the nearest multiple of 10 lbs.) } ..... = 1090 lbs.

To find the extension at \$24.00 per ton —

Divide the quantity by 2000..... = .545 ton

Or better, multiply the quantity by one half the price and point off three places = \$13.08

### METHOD 2

With the larger Comptometer—

Add in the Gross on the right side of machine	4800
Subtract out the Tare.....	3160
	1640

Leave this in the machine and multiply by .6667.

Use Keys 6666 at the left of amount in Register. (See page 39.)

Point off four places..... 1093

Leave this in the machine and multiply by 12,  
one-half of the rate per ton.....\$13.08

As we are to treat this as 1090# multiply only by the 109 ignoring the 3, or subtract the 3 lbs., if preferred; it is immaterial.

### Prove by Re-Figuring

or

With the \$13.08 in the machine, prove the extension by Negative Multiplication..... = 1090

Add one half of this amount to itself, or multiply it by 1.5, (Keys 14 from left of 1090)... = 1635

Add the Tare..... = 3160

Equals the Gross within a few pounds, due to taking only multiples of 10 lbs. in the weights.. = 4795

**PRODUCT TICKET**

Cotton seed meal is put up in 100 lb. sacks. The price is by the ton, so one-twentieth of ton price gives the price per sack.

Cotton seed hulls are priced by the ton and charged by the weight in pounds.

---

No. 2129                      Memphis, January 7, 1913.

JAMES EAGLE

Bought of

UNITED STATES COTTON OIL CO.

---

3 sacks Cotton Seed Meal @ \$27.00 ton	\$4.05
1820 lbs. Loose C. S. Hulls @ 9.50 ton	8.65
	<hr/>
	\$12.70

---

In figuring pounds by the price, hold the price keys, divide the pounds by 2 mentally and, at the same time, multiply by this result toward the right.

---

**OTHER WORK AT THE GIN**

Figuring farmers' seed tickets, both cash and charge;

Making Daily Custom Gin Report for the Government;

Making weekly Recap. of all Ginning, Purchases and Sales;

Making monthly Product Report;

Balancing Daily Cash;

Also other general Bookkeeping work.

## COTTON BROKERS

## ACCOUNT SALES

A Cotton Broker may sell from one to a dozen or more bales of Cotton for a client.

This requires—

- Extending Quantities by Price
- Extending and deducting Freight
- Extending and deducting Storage
- Extending and deducting Insurance
- Extending and deducting Commission
- Totaling weights and money

First extend the quantities by the prices individually and total. Leave this in the machine and figure the commission, multiplying by "Three Factor Method", (p. 39). Add the charges. Clear the machine. Add in the Gross Receipts; then deduct the amount of charges.

EXAMPLE:

Sales by GOODLETT & COMPANY of <b>3</b>				Bales Cotton			
For Account of <i>Mayer &amp; Co.</i>				Sold to <i>Shelby Matthews Co.</i>			
<i>909</i>	<i>535<sup>4</sup></i>	<i>a</i>	<i>9 1/4 c</i>			<i>5087</i>	
<i>914</i>	<i>617</i>		<i>9 1/4 c</i>			<i>5814</i>	
<i>917</i>	<i>438</i>		<i>10 c</i>			<i>4380</i>	
	<i>1585</i>					<i>15776</i>	
	Freight	CHARGES:	Charges <i>1 75</i>	<i>3 75</i>			
	Drayage						
	Storage Paid		<i>.35</i>	<i>1 05</i>			
	Insurance		<i>.75</i>	<i>75</i>			
	Commission <i>2 1/2%</i>			<i>3 87</i>		<i>937</i>	
		Net Proceeds					
Memphis, Tennessee, May 10, 1912						<i>14339</i>	

### FOREIGN COTTON SHIPMENTS

The prices are almost universally quoted in English Pence and range from 4.25d. to 8.75d.

Freight Rates will range from \$0.25 to \$2.00 per Cwt.

Rate of Exchange on freight is almost universally \$4.80

Thus 480 cents=240 pence

2 cents=1 penny.

An easy method of figuring freight is to divide the rate in cents by 2, which gives the rate in pence.

Then, multiply the Cwt. by the rate in pence—

Or, multiply one-half of the pounds by the rate in currency.

If using this latter method, hold the price keys on left of keyboard; divide the weight by 2 mentally, making each multiplication as you divide.

### EXAMPLE:

<b>EBNER &amp; Co.,</b> <b>PARIS, FRANCE</b> <b>To U. S. COTTON CO., DR.</b>				
GROSS	TARE	NET	PRICE	
48260	6 per cent	45364	6.22d. per lb.	282,164d.
Freight 98c cwt.				23,647d.
				258,517d.
				27,144.28 fr.

### METHOD

Find the net weight—

6% of Tare leaves 94% net.

94% of 48260 . . . . . = 45364 lb net

45364 × 6.22d. . . . . = 282164d. gross

48260 × 49d. (½ of rate in c) 23647d. Frt.

Net Invoice . . . . . 258517d.

258517d. × .105 (francs per d.) = 27144.28 Francs

To reduce pence to Francs—

25.20 Francs = 1 Pound Sterling, or 240d.

25.20 ÷ 240 . . . . . = .105 Francs per Penny.



## TEXTILE MANUFACTURING

The principal departments in mills devoted to weaving cloth are:—

1. Opening
2. Picking
3. Carding
4. Spinning
5. Spooling  
Warping  
Slashing
6. Weaving
7. Cloth &  
Packing
8. Shipping.

In these five departments, the cotton is taken in its raw state, cleaned, carded, spun into thread, sized, dried and put on spools.

The principal accounting departments, where the Comptometer is invaluable, are:

- \* Bookkeeping,
- \* Cashier,
- \* Purchasing Dept.,
- Invoice Dept.,
- Payroll Dept.,
- Cost Department.

\* For detail see—"Bookkeeping," "Cashier," and "Purchasing Department."

Each department is individualized. It is charged with its—

Power Cost,  
Heat Cost,  
Labor Cost,  
Material Cost,  
Burden, etc.

as though each was an entirely separate and distinct concern.

It is given credit for its entire production;—thus, the net earning of each department is ascertained.

Daily reports are made by each department head, so that the exact condition of every order being put through is known daily.

## PURCHASE DEPARTMENT

The **Incoming Invoices** are varied and subject to numerous discounts. The Fixed Decimal Method and 10 or 12-column Comptometer is the ideal for handling this work.

### PERPETUAL INVENTORY OF RAW STOCK

**Stock purchased** is in bags or bales, in lots of 5 to 100 or more.

**Stock Record.** Consecutive lot numbers are given each purchase and a record made on a Stock Card or Book, as goods are purchased and received. Each Stock Card is given credit when any of its goods are used or transferred.

A **Perpetual Inventory** of finished goods is kept in much the same order.

**Coal Bills.** The coal is usually delivered in loads. A slip is made out showing the amount in pounds of each load and these are added for totals, then reduced to Gross Tons and figured at the price per ton.

## INVOICE DEPARTMENT

The quantities in yards are usually large and many fractions in quarters or eighths, while the prices may be as low as thirty-seconds,—as:

14,503 $\frac{3}{4}$ yds. @ 14 $\frac{1}{8}$ c yd.....	\$2,057.72
23,248 " " 12 $\frac{1}{2}$ c ".....	2,840.62
2,340 " " 9 $\frac{1}{2}$ c ".....	222.30
8,648 " " 87c ".....	
Less 7%	6,997.10
25,006 lbs. @ 17 $\frac{3}{4}$ c lb.....	4,438.56
	<hr/>
	\$16,556.30

These should be figured over the Fixed Decimal. In proving, accumulate over the Fixed Decimal, proving both the extensions and additions in the same operation. This leaves no possibility of a compensating error.

### EXAMPLES:

1 bale Ticking, 1765 $\frac{3}{4}$  yds., @ 6 $\frac{3}{4}$ c... = \$119.19

Damask the manufacturers figure to the eighth, the wholesaler to the inch.

46 $\frac{5}{8}$  yds. @ \$3.75..... = \$174.84

2 yds. 25 inches @ \$4.50 per yd.

Reduce the inches to decimal of a yard—

25 inches = .6944

Multiply 2.6944  $\times$  4.50, over Fixed Deci-

mal..... = \$12.13

The value of "Comptometer Accuracy" cannot be over-estimated on this work.

## PAYROLLS

The Payrolls are nearly all Piece Work. The majority of items contain fractions. The Comptometer, with the Fixed Decimal Method, is soon found to be invaluable.

In the Opening, Packing, Carding, Spinning and Spooling Departments, the Payroll is largely based upon the number of pounds handled.

A "Cut" is the same as a "bolt" of cloth. They will range around 40 and 60 yards, in fractions of yards, as— $49\frac{3}{4}$ ,  $58\frac{1}{2}$ ,  $63\frac{1}{4}$ .

### SAMPLES OF PAYROLL WORK

<b>Hour Basis</b>	52 5/6 Hours @ $12\frac{3}{4}$ c	\$6.74
60 hour week	47 " " 14c	6.58
Figured in Sixths	54 1/6 " " $16\frac{1}{4}$ c	8.80
		<u>\$22.12</u>

<b>Pound Basis</b>	1342 lbs. @ 29c cwt.	
	567 " " 31c	
		<u>\$5.65</u>

Make all extensions over the Fixed Decimal (p 14.)

In the Weaving, the Payroll is generally based on the "Cut," or yards.

### Yard Basis

The Weavers will usually have been employed on several different kinds of work, or cloth, at different prices. There are many deductions for money, supplies or fines for poor work.

### EXAMPLE:

43 $\frac{1}{4}$ yds. @ .0632	
50 " " .0715	
89 $\frac{1}{2}$ " " .0527	<u>        </u>
	\$11.03
Less 2 $\frac{3}{4}$ c on 16 yds.—	
Cash \$2.00.....	<u>2.44</u>
	\$8.59

In figuring Payrolls, it is best to determine the amount of deduction first—i. e.,

16 yds. @ $2\frac{3}{4}$ c + \$2.00.....	= \$2.44
Then, accumulate the Gross Wage.....	= 11.03
and subtract out the pre-determined amount.....	<u>2.44</u>
Equals the Net Wage.....	<u>\$8.59</u>

## QUARTERLY REPORTS

This requires the accumulation and compiling of a lot of data.

The report contains—

The value in dollars and cents and the yards of each article made,

The value in dollars and cents and the weight of raw cotton,

The value in dollars and cents and the cotton in process,

The value in dollars and cents and the finished goods,

The value in dollars and cents and the supplies,

The value in dollars and cents and the machinery and plant, etc., etc.

## STATISTICAL

The Statistical Work in Textile Manufacturing is voluminous and differs in each plant.

Some data required is—

The Cost of each job in each Department.

The Cost per pound in each Department.

e. g.—

9850 lbs. of Cotton is started through for a certain job.

The Total Cost of the job is determined in each department, then divided by the total number of pounds and carried out to the sixth or seventh decimal for the cost per pound in the department.

Some other Statistical and Cost Work consists of:

Reduction of Yards to Pounds,

Reduction of Yards to Pounds,

" " Dozens to "

" " Yards to Dozen,

Percentage of Production in the various departments,

Computations of Electric Power from daily readings of K. W. Hours, to flat rate of Horse Power per year, etc.,

Working up Average Dating on Sales.

Accuracy is the prime element in this work. Much of it will run into five or more decimals.

## DETERMINING THE COST PER YARD

The cloth, such as Duck, Muslin, Calico, Sheeting, etc., are known by the number of pounds of cotton to the yard.

Duck is referred to as 6, 8, 10 or 12 oz. Duck.

Cotton Sheeting is 3, 4 or 5 yards,—i. e., so many yards to the pound.

EXAMPLE:

9850 lbs. of Cotton is made up in 6 oz. Duck. The cost in one department is .013465 per lb. What is the cost per yard? Each yard of Duck weighs 6 ounces.

## METHOD

$6/16$  or  $\frac{3}{8}$  of .013465 = Cost per yard.

Multiply .013465 by 3 and divide by 8 = .0050494

Multiply .013465 by .375, (the decimal for  $\frac{3}{8}$ )..... = .0050494

## AVERAGING GOODS

The mill requires a check on each lot of goods, to see that it is running the proper weight. Upon finishing each bale or case of goods, it is weighed and the weight divided by the number of yards in the bale, to give the average weight per yard.

## TEXTILE

### POUNDS, OUNCES AND DRAMS

Silk, either raw or on spools, is figured on the basis of 16 drams to the ounce, 16 ounces to the pound. The rate is by the pound.

EXAMPLE:

18 lbs. 7 oz. 8 dr. @ \$4.10 per lb.

#### METHOD

Looking at the Table, at the converging point of the 8 dram and 7 oz. columns, it is seen that 7 oz. and 8 dr. equals .4688 of a pound.

Use the Fixed Decimal Method. Take the Key Position on \$4.10 and multiply by 18.4688, i. e., moving to the left one place for **Tens Figure** of quantity, multiply toward the right, equals 75.72.

The accompanying Decimal Table gives the decimals of a pound for any number of drams and ounces.

OUNCES AND DRAMS REDUCED TO DECIMAL OF A POUND																	
Drams	OUNCES															Drams	
		1 oz.	2 oz.	3 oz.	4 oz.	5 oz.	6 oz.	7 oz.	8 oz.	9 oz.	10 oz.	11 oz.	12 oz.	13 oz.	14 oz.		15 oz.
		.0625	.125	.1875	.25	.3125	.375	.4375	.5	.5625	.625	.6875	.75	.8125	.875	.9375	
1	.0039	.0664	.1289	.1914	.2539	.3164	.3789	.4414	.5039	.5664	.6289	.6914	.7539	.8164	.8789	.9414	1
2	.0078	.0703	.1328	.1953	.2578	.3203	.3828	.4453	.5078	.5703	.6328	.6953	.7578	.8203	.8828	.9453	2
3	.0117	.0742	.1367	.1992	.2617	.3242	.3867	.4492	.5117	.5742	.6367	.6992	.7617	.8242	.8867	.9492	3
4	.0156	.0781	.1406	.2031	.2656	.3281	.3906	.4531	.5156	.5781	.6406	.7031	.7656	.8281	.8906	.9531	4
5	.0195	.0820	.1445	.2070	.2695	.3320	.3945	.4570	.5195	.5820	.6445	.7070	.7695	.8320	.8945	.9570	5
6	.0234	.0859	.1484	.2109	.2734	.3359	.3984	.4609	.5234	.5859	.6484	.7109	.7734	.8359	.8984	.9609	6
7	.0273	.0898	.1523	.2148	.2773	.3398	.4023	.4648	.5273	.5898	.6523	.7148	.7773	.8398	.9023	.9648	7
8	.0313	.0938	.1563	.2188	.2813	.3438	.4063	.4688	.5313	.5938	.6563	.7188	.7813	.8438	.9063	.9688	8
9	.0352	.0977	.1602	.2227	.2852	.3477	.4102	.4727	.5352	.5977	.6602	.7227	.7852	.8477	.9102	.9727	9
10	.0391	.1016	.1641	.2266	.2891	.3516	.4141	.4766	.5391	.6016	.6641	.7266	.7891	.8516	.9141	.9766	10
11	.0430	.1055	.1680	.2305	.2930	.3555	.4180	.4805	.5430	.6055	.6680	.7305	.7930	.8555	.9180	.9805	11
12	.0469	.1094	.1719	.2344	.2969	.3594	.4219	.4844	.5469	.6094	.6719	.7344	.7969	.8594	.9219	.9844	12
13	.0508	.1133	.1758	.2383	.3008	.3633	.4258	.4883	.5508	.6133	.6758	.7383	.8008	.8633	.9258	.9883	13
14	.0547	.1172	.1797	.2422	.3047	.3672	.4297	.4922	.5547	.6172	.6797	.7422	.8047	.8672	.9297	.9922	14
15	.0586	.1211	.1836	.2461	.3086	.3711	.4336	.4961	.5586	.6211	.6836	.7461	.8086	.8711	.9336	.9961	15

## KNITTING MILLS

The following will illustrate some of the statistical work required in a Knitting Mill. In a general way, it is significant of the class of work necessary in every Textile factory.

The information wanted is:—

**The General Expense Cost per Pound;**

**The Labor Cost per Pound;**

**Each Expense Cost per Pound;**

**Total Departmental Expense per Pound;**

exclusive of labor.

### METHOD

The first operation is to find the General Cost per pound.

Material Cost      \$29353.53 ÷ 70663 = 41.54c  
 Advertising Cost    19042.85 ÷ 101240 = 18.81c  
 Selling Cost        25691.33 ÷ 101240 = 25.38c

Note: Quotient .4154 1198 Remainder.

Prove the Division directly.

Clear the machine and multiply the Quotient—

.4154 × 70663 (the Divisor) = \$29353.4102

Add in the Remainder . . . . . 1198

Equals the Dividend . . . . . \$29353.5300

A 10 or 12-column Comptometer should be used for this class of work.

### METHOD No. 2

Turn to the "Reciprocal Table" for the reciprocals of the three highest figures of Divisors, (or work them out). The reciprocal for:

707 is 14144

1012 is 98814

687 is 14556

668 is 14970

929 is 10764

682 is 14663

690 is 14493

1012 is 98814

Hold the reciprocals for Key Factors, splitting so as to hold only two or three keys at one time.

Multiply each amount by its corresponding "Reciprocal."

Amounts	Reciprocals	Quotient (by multiplication)
\$29,353.53 ×	14144	= \$41.52
19,042.85 ×	98814	= 18.82
25,691.33 ×	98814	= 25.39
21,045.45 ×	14144	= 29.79

Continue in this manner for the entire statement.

UNITED STATES KNITTING MILLS					
Material and Labor Costs in Cents per Pound for Period of Five Months					
	Amount	Output	RESULTS BY DIVISION		Results by Using Reciprocals of 3 Highest Figures
			Cost per Pound	Cost Labor	
Material.....	\$29353.53	70663	41.54		41.52
Advertising.....	19042.85	101240	18.81		18.82
Selling.....	25691.33	101240	25.38		25.39
Labor.....	21045.40		29.79		29.79
<b>POWER DEPT.</b>		68675			
Labor.....	273.65		.40	.40	.40
Fuel.....	775.75		1.13		1.16
Oil.....	88.75		.13		.13
Water.....	30.00		.04		.04
Repairs.....	147.60		.22		.22
Sundries.....	37.45		.05		.05
<b>P. DEPT. TOTAL</b>	<b>\$ 1079.55</b>		<b>1.57</b>	<b>.40</b>	<b>1.57</b>
<b>KNITTING DEPT.</b>		70663			
Labor.....	\$14572.53		20.62	20.62	20.61
Needles.....	246.70		.35		.35
Oil.....	34.20		.05		.05
Repairs.....	727.83		1.03		1.03
Sundries.....	401.47		.57		.57
<b>K. DEPT. TOTAL</b>	<b>\$1410.20</b>		<b>2.00</b>	<b>20.62</b>	<b>2.00</b>
<b>DYEING DEPT.</b>		66794			
Labor.....	\$ 482.68		.72	.72	.72
Dye Stuff.....	3214.44		4.81		4.81
Oil.....	17.68		.03		.03
Water.....	8.75		.01		.01
Repairs.....	247.82		.37		.37
Sundries.....	69.73		.10		.10
<b>D. DEPT. TOTAL</b>	<b>\$ 3558.42</b>		<b>5.32</b>	<b>.72</b>	<b>5.32</b>
<b>FINISHING DEPT.</b>		92879			
Labor.....	\$ 948.00		1.02	1.02	1.02
Oil.....	267.38		.29		.29
Repairs.....	178.80		.19		.19
Sundries.....	33.70		.04		.04
<b>S. DEPT. TOTAL</b>	<b>\$ 479.88</b>		<b>.52</b>	<b>1.02</b>	<b>.52</b>
<b>BOARDING DEPT.</b>		68203			
Labor.....	\$ 2296.40		3.37	3.37	3.37
Press Boards.....	127.60		.19		.19
Form Boards.....	38.80		.06		.06
Repairs.....	15.51		.02		.02
<b>B. DEPT. TOTAL</b>	<b>\$ 181.91</b>		<b>.27</b>	<b>3.37</b>	<b>.27</b>
<b>FINISHING DEPT.</b>		69041			
Labor.....	\$ 1889.63		2.74	2.74	2.74
Tags and Labels.....	2326.32		3.37		3.37
Ink and Stamps.....	276.30		.40		.40
Paper Boxes.....	4532.80		6.57		6.57
Repairs.....	360.00		.52		.52
Sundries.....	125.23		.18		.18
<b>F. DEPT. TOTAL</b>	<b>\$ 7620.65</b>		<b>11.04</b>	<b>2.74</b>	<b>11.04</b>
<b>SHIPPING DEPT.</b>		101240			
Labor.....	\$ 582.51		.58	.58	.58
Shooks.....	876.00		.87		.86
Paper and Twine.....	197.35		.19		.20
Sundries.....					
<b>S. DEPT. TOTAL</b>	<b>\$ 1073.35</b>		<b>1.06</b>	<b>.58</b>	<b>1.06</b>

## GRAIN BROKERS AND ELEVATORS

Grain Brokers, Elevators and Mills find the Comptometer a **wonderful aid in their figuring**. The information wanted requires the keeping of a number of books of record and the amounts are unusually large; hence, accuracy is an invaluable feature.

Grain is usually purchased in carload lots. The quantity is first entered in pounds, then the number of bushels and remaining pounds is determined.

Prior to the use of the Comptometer, these results have been obtained mentally or from a book which gives the bushels and remaining pounds in various quantities. It was subject, first, to errors in reading the wrong results owing to the necessity for picking them out from among hundreds of others. Second, the process was comparatively slow.

The Comptometer produces all grain results in a **minimum of time and with positive accuracy**. It is much easier to place the fingers on the large keys of the Comptometer, depress them and read the results than to even find a place in a book. The attention is thus continually centered on the work.

### USES

The general uses for the Comptometer and the work which it performs in the most efficient manner possible are—

#### BOOKKEEPING

- Footing and balancing cash book
- Proving daily postings
- Balancing ledger accounts
- Trial balance
- Footing grain journal
- Adding bushels and pounds
- Reducing pounds into bushels
- Figuring accounts of sale
- Footing account sales
- Proving purchase invoices
- Footing purchase ledger
- Footing ledger and cash book
- Figuring dockage—gross and net bushels  
in wheat, rye, flax, etc.
- Extending elevator reports
- Proving warehouse tickets
- Figuring interest
- Insurance
- Proving branch reports
- Proving elevator reports

**BOOKKEEPING**

For the Bookkeeping Work see index.

**ADDING BUSHEL AND POUNDS**

In adding columns of bushels and pounds, the best plan is—

Add the pounds first=	270	CORN	
Reduce to bushels, i. e.—		Bu.	Lbs.
Divide by 56# per bu.=		1067	40
4 bu. 46 lbs.		984	55
Then add the bushels—		1032	45
		1246	38
		1562	25
		1148	30
		1627	37
Equals.....		8670	46

**REDUCING POUNDS TO BUSHEL**

Here the division is always two figures. Division by the cipher method is very simple and rapid:—

EXAMPLE:

86470 lbs. of Corn; how many bushels?

Add the dividend 86470 in the machine, starting in one column from the left. Hold, with the Divisor Keys, the small o key at the left, i. e., hold small o55.

In each Divisor Position, merely depress these keys until the Active Dividend becomes smaller than the Divisor. If the answer is wanted in bushels and remaining pounds, stop when the last Active Dividend of the quantity has been reduced. By using this additional key, the Quotient is carried one place further to the left and eliminates the counting of the key depressions against the Changing Quotient.

$86470 \div 56 = 1544$  bushels 6 pounds.



## HAY

Hay is sold by the Net Ton or Hundredweight. The Comptometer is exceedingly convenient and time-saving for use in totaling the weights of the various bales and the extensions by either of the methods illustrated below:

## EXAMPLE:

3680# Clover Hay	@	\$18.00.....	\$ 33.12
12240# Timothy Hay	@	17.50.....	107.10
9680# Oat Straw	@	9.25.....	44.77
			<u>\$184.99</u>

The "Tally" Sheet would show about as follows:

22 Bales Clover Hay			
160	179	213	156
167	167	184	170
168	134	167	142
173	156	153	186
154	178	209	
145	172	147	3680#

## METHOD No. 1

Add the Tally Sheet.

Then clear and extend by the price. Hold the price keys and divide the weight by 2, mentally, while multiplying, i. e.,

$$\begin{array}{r} 2 \overline{) 3680} \\ 18 \times 1840 = \$33.12 \end{array}$$

## METHOD No. 2

Add the Tally Sheet.

Leave this weight in the machine and multiply, ("Three Factor" Method), by one-half of the price, (which is equivalent to reducing the tons to pounds).

$$9 \times 3680 = \$33.12$$

## PROVING RECEIVED INVOICES

64,660 lbs. No. 2 Wheat, 1077 bu. 40 lbs. at  $95\frac{1}{2}c$ .....\$1029.17  
 Less freight at  $8\frac{3}{4}c$  per cwt..... 56.58  
**\$ 972.59**

### METHOD

First, prove the number of bushels.

Multiply the number of bushels by the weight per bushel and add in the pounds.

$$1077 \times 60 + 40 = 64660$$

Extend the freight.

$$64660 \times 8\frac{3}{4} = \$56.58$$

Extend the bushels and decimals of bushel by the price, reading the decimal of a bushel from the Grain Decimal Table.

$$1077.667 \times .955 = \$1029.17$$

Deduct the freight extension 56.58

$$\underline{\$ 972.59}$$

### METHOD No. 2

Arrives at the price direct without any reference to the number of bushels.

Multiply the weight by the price from the left side of the keyboard, (starting in one column from the left.) This registers the result in the proper place to continue with the division and carry out decimally.  $64660 \times .955$ .....61750.3

Leave this result in the machine and divide by the weight per bushel, 60 .....\$1029.17

### Freight:

Figure the freight item first, so that it is ready to deduct when the amount of the invoice is calculated and in the machine.

### GRAIN DECIMAL TABLE

This table shows the decimal of a bushel of any number of pounds to the 3rd place.

Its use:

1264 bu. 24 lbs. of Corn at 65c.

The table shows that 24 lbs. equals .429.

Therefore multiply 1264.429 by 65 preferably over the Fixed Decimal or from the left of keyboard=\$821.88.

### DECIMALS OF A BUSHEL

	Wheat, Barley, Peas, Clover, Potatoes 60 lbs. to Bushel		Corn, Rye Fixed, Apples 56 lbs. to Bushel		Barley 48 lbs. to Bu.		Timothy 45 lbs. to Bu.		Oats 32 lbs. to Bu.	
	Lbs.	Dec. of Bu.	Lbs.	Dec. of Bu.	Lbs.	Dec. of Bu.	Lbs.	Dec. of Bu.	Lbs.	Dec. of Bu.
10	1	.017	1	.018	1	.021	1	.022	1	.031
	2	.033	2	.036	2	.042	2	.044	2	.063
	3	.05	3	.054	3	.063	3	.067	3	.094
	4	.067	4	.071	4	.083	4	.089	4	.125
	5	.083	5	.089	5	.104	5	.111	5	.156
	6	.1	6	.107	6	.125	6	.133	6	.188
	7	.117	7	.125	7	.146	7	.156	7	.219
	8	.133	8	.143	8	.167	8	.178	8	.25
	9	.15	9	.161	9	.188	9	.2	9	.281
	10	.167	10	.179	10	.208	10	.222	10	.313
20	11	.183	11	.196	11	.229	11	.244	11	.344
	12	.2	12	.214	12	.25	12	.267	12	.375
	13	.217	13	.232	13	.271	13	.289	13	.406
	14	.233	14	.25	14	.292	14	.311	14	.438
	15	.25	15	.268	15	.313	15	.333	15	.469
	16	.267	16	.286	16	.333	16	.356	16	.5
	17	.283	17	.304	17	.354	17	.378	17	.531
	18	.3	18	.321	18	.375	18	.4	18	.563
	19	.317	19	.339	19	.396	19	.422	19	.594
	20	.333	20	.357	20	.417	20	.444	20	.625
30	21	.35	21	.375	21	.438	21	.467	21	.656
	22	.367	22	.393	22	.458	22	.489	22	.688
	23	.383	23	.411	23	.479	23	.511	23	.719
	24	.4	24	.429	24	.5	24	.533	24	.75
	25	.417	25	.446	25	.521	25	.556	25	.781
	26	.433	26	.464	26	.542	26	.578	26	.813
	27	.45	27	.482	27	.563	27	.6	27	.844
	28	.467	28	.5	28	.583	28	.622	28	.875
	29	.483	29	.518	29	.604	29	.644	29	.906
	30	.5	30	.536	30	.625	30	.667	30	.938
40	31	.517	31	.554	31	.646	31	.689	31	.969
	32	.533	32	.571	32	.667	32	.711		
	33	.55	33	.589	33	.688	33	.733		
	34	.567	34	.607	34	.708	34	.756		
	35	.583	35	.625	35	.729	35	.778		
	36	.6	36	.643	36	.75	36	.8		
	37	.617	37	.661	37	.771	37	.822		
	38	.633	38	.679	38	.792	38	.844		
	39	.65	39	.696	39	.813	39	.867		
	40	.667	40	.714	40	.833	40	.889		
50	41	.683	41	.732	41	.854	41	.911		
	42	.7	42	.75	42	.875	42	.933		
	43	.717	43	.768	43	.896	43	.956		
	44	.733	44	.786	44	.917	44	.978		
	45	.75	45	.804	45	.938				
	46	.767	46	.821	46	.958				
	47	.783	47	.839	47	.979				
	48	.8	48	.857						
	49	.817	49	.875						
	50	.833	50	.893						
60	51	.85	51	.911						
	52	.867	52	.929						
	53	.883	53	.946						
	54	.9	54	.964						
	55	.917	55	.982						
	56	.933								
	57	.95								
	58	.967								
	59	.983								

**ACCOUNT SALE  
FROM BROKER MAKING THE SALE**

**B. C. Christopher Grain Co.**

In account with

**A. C. COOPER & CO., Omaha, Neb.**

**ACCOUNT SALES RENDERED**

CAR NUMBER	WEIGHT	BU.	DESCRIP- TION	RECEIVED	BU.	PRICE	AMOUNT
18753	90000	1500	#2 Wheat	87,630	1460 - 1/2 bu.	1.10	\$1606.55
			Draft		1550.00		
			Storage 1/20 day 6 days		6 00		
			Com 1/2% per		7 30		
			Frt 8 1/2¢ Cwt		74.50		
			Interest 6 days		1 55		
			6% on \$1550.00		50		
			Weighing		50		
			Inspection				
			Amount owing Consignee				33.80
					1640.35		\$1640.35

**EXPLANATION**

The Consignee usually allows 5 days without interest but charges 6% for any extra time.

The shipper draws a draft on the consignee for the gross amount. It is attached to the Bill of Lading. Settlement is made on the actual sales receipts.

The **Comptometer operations** are:—

Making the Extensions,  
Figuring the Commission,  
Figuring the Interest,

Figuring the Freight,  
Deducting the Freight,  
Adding the Expense items and  
Balancing.

## GRAIN BROKER'S INVOICE

The following is a good example of the Grain Broker's Invoice.

It shows the number of pounds in each car.

The number of bushels in each car.

The freight rate for each car.

The freight extension for each car.

The price.

The net extension for each car.

The totals of weight, bushels, freight and net extensions.

The interest on drafts paid on delivery of cars.

MIDLAND ELEVATOR CO.					GRAIN INVOICE					KANSAS CITY, MO., July 7/10.		
Account Purchase of Lincoln Grain Co., Lincoln, Neb.												
Applied on purchase of 6/13 5M bu. Corn @ 61½							Terms: K. C.					
Date	Car	Init.	Grade	Grain	Pounds	Rate	Freight	Bushels	Price	Track	Amount	
Shea	102484	Q	3N	Corn	71 2 0 0	955	6 8. 0 0	1 2 7 1 24	61½		7 1 3.93	
Benedict	34590	Q	2N	"	63 5 0 0	1327	8 4. 2 7	1 1 3 3 52	"		6 1 3.10	
Goehner	84896	CNW	2N	"	88 2 5 0	1147	1 0 1. 2 2	1 5 7 5 50	"		8 6 7.95	
Pickrell	66939	NP	2N	"	63 0 0 0	995	6 2. 6 9	1 1 2 5 00	"		6 2 9.19	
	700-6/16				28 5 9 5 0		3 1 6. 1 8	5 1 0 6 14			2 8 2 4.17	
	600-6/20											
	820-6/18											
	610-6/22											
	2730											
POINT OF ORIGIN												
Shea Siding via Endicott, Neb.					Interest on					9 04		
Benedict					\$700 for 4 da. \$0.47					5 75		
Goehner					600 " 3 " .30							
Pickrell					820 " 14 " 1.91					3 29		
					610 " 6 " .61							
					\$3.29					Net 2 8 1 5.13		

See "Method" on following page.

**GRAIN—Continued****METHOD**

Extend the pounds by freight

$$71200 \times .0955 \text{ cwt.} = 68.00 \text{ etc.}$$

Reduce the pounds to bushels

$$71200 \div 56 = 1271 \text{ bu. } 24 \text{ lbs.}$$

Multiply the bushels by price per bushel.

A good plan is to multiply from the left,

and read the decimal for the odd pounds

from table  $.615 \times 1271.429 = 781.93$

Deduct the freight  $781.93 - 68.00 = 713.93$

Complete the extensions in this manner and total each column.

Then figure the Interest.

The consignee has paid the draft for the approximate value of the grain several days before it is delivered to him at destination. He charges interest for the lapsed time.

Interest on \$700.00 for 4 days at 6%

" " 600.00 " 3 " " "

" " 820.00 " 14 " " "

" " 610.00 " 6 " " "

This class of Interest is best figured as follows:

Point off 3 places in principal gives the interest for 6 days.

Use the Fixed Decimal.

Hold the key position on the principal and multiply by the "multiple" of 6 day periods—i. e.

Hold  $.7 \times .6667$  (4 days is  $\frac{2}{3}$  or  $.66\frac{2}{3}$  of 6 days)

$.6 \times .5$  (3 days is  $.5$  of 6 days)

$.82 \times 2.3333$  (14 days is  $2\frac{1}{3}$  or  $2.33\frac{1}{3}$  of 6 da.)

$.61 \times 1.$  (6 days is one period)

Interest \$3.29

If the interest on each individual item is not required, accumulate to the total.

## GRAIN—COMMISSIONS

### STOCK EXCHANGE TRANSACTIONS

Transactions on the Exchange are usually in lots or multiples of five thousand. This is figured by moving the decimal point four places to the right, which is the amount for 10,000 bushels, and divide by two for 5,000, or add one-half for 15,000 or double it for 20,000.

EXAMPLE:

B. C. COOPER & CO.,		
Account of Baldwin		
Date	Amount	
8/4	5M @ 91 $\frac{3}{4}$ = \$4587.50	Sold 5 M @ 93 $\frac{1}{4}$ =
	Com. $\frac{1}{8}$ c. bu. 6.25	\$4662.50
	Tax .25	
	Profit 68.50	
	<u>\$4662.50</u>	<u>\$4662.50</u>

The Comptometer can be used to excellent advantage on this work, as a relief, on the extensions and in footing and balancing.

The Comptometer renders valuable service by reason of the invariable accuracy of the results obtained.

### ELEVATORS

Grain Companies owning Elevators charge **storage** as follows:

For first 15 days  $\frac{3}{4}$ c. per bu. for Elevation charge.

Additional time 1-30c. per bu. per day for Storage.

EXAMPLE:

8645 bushels in Storage 28 days.

#### METHOD

First determine the net charge **per bushel**. Use the Fixed Decimal in the eighth place.

Add in the charge for the first 15 days.... .0075

Multiply the Storage Rate per day by the remaining days,—

13 × .000333 (net charge per bu. accumulating)  
..... .011833.

Then multiply same by the number of bushels,—

8645 × .011833.....\$102.30

## DOCKAGE

A "Dockage" for dirt is sometimes figured on Wheat, Rye, Flax and Oats.

It will run from  $\frac{1}{2}$  lb. to  $6\frac{1}{2}$  lbs. to the bushel.

The rate of Dockage is determined by a test.

## THE EASY COMPTOMETER WAY

The Dockage table herewith gives the dockage in bushels, which represents the dirt, and the net bushels per 1000 pounds at the various rates of dockage.

EXAMPLE:

74260# Wheat, 3% Dockage.

How many Net Bu. of Wheat?

How many Bu. Dockage?

Multiply the number of thousand pounds by the net bushels per M. and by the dockage.

$$74260 \times 15.833 = 1175.76$$

$$74260 \times .8333 = 61.88$$

WHEAT			FLAX			RYE		
Rate of Dock.	Net Bu. per 1,000 lbs.	Dockage	Rate of Dock.	Net Bu. per 1,000 lbs.	Dockage	Rate of Dock.	Net Bu. per 1,000 lbs.	Dockage
$\frac{1}{2}$	16.5277	.1388	$\frac{1}{2}$	17.7679	.0893	$\frac{1}{2}$	17.6977	.1594
1	16.3888	.2777	1	17.6786	.1786	1	17.5383	.3189
$1\frac{1}{2}$	16.2500	.4166	$1\frac{1}{2}$	17.5893	.2679	$1\frac{1}{2}$	17.3788	.4783
2	16.1111	.5555	2	17.5000	.3571	2	17.2194	.6378
$2\frac{1}{2}$	15.9722	.6944	$2\frac{1}{2}$	17.4107	.4464	$2\frac{1}{2}$	17.06	.7972
3	15.8333	.8333	3	17.3214	.5357	3	16.9005	.9566
$3\frac{1}{2}$	15.6944	.9722	$3\frac{1}{2}$	17.2321	.6250	$3\frac{1}{2}$	16.7411	1.1161
4	15.5555	1.1111	4	17.1429	.7143	4	16.5816	1.2755
$4\frac{1}{2}$	15.4166	1.2500	$4\frac{1}{2}$	17.0536	.8036			
5	15.2777	1.3888	5	16.9643	.8929			
$5\frac{1}{2}$	15.1388	1.5277	$5\frac{1}{2}$	16.8750	.9821			
6	15.0000	1.6666	6	16.7857	1.0714			
$6\frac{1}{2}$	14.8611	1.8055	$6\frac{1}{2}$	16.6964	1.1607			
7	14.7222	1.9444	7	16.6071	1.2500			
$7\frac{1}{2}$	14.5833	2.0833	$7\frac{1}{2}$	16.5179	1.3393			
8	14.4444	2.2222	8	16.4286	1.4286			
$8\frac{1}{2}$	14.3055	2.3611	$8\frac{1}{2}$	16.3393	1.5179			
9	14.1666	2.5000	9	16.2500	1.6071			
$9\frac{1}{2}$	14.0277	2.6388	$9\frac{1}{2}$	16.1607	1.6964			
10	13.8888	2.7777	10	16.0714	1.7857			
$10\frac{1}{2}$	13.7500	2.9166	$10\frac{1}{2}$	15.9821	1.8750			
11	13.6111	3.0555	11	15.8929	1.9643			
$11\frac{1}{2}$	13.4722	3.1944	$11\frac{1}{2}$	15.8036	2.0536			
12	13.3333	3.3333	12	15.7143	2.1429			
$12\frac{1}{2}$	13.1944	3.4722	$12\frac{1}{2}$	15.6250	2.2321			
13	13.0555	3.6111	13	15.5357	2.3214			
$13\frac{1}{2}$	12.9166	3.7500	$13\frac{1}{2}$	15.4464	2.4107			
14	12.7777	3.8888	14	15.3571	2.5000			
$14\frac{1}{2}$	12.6388	4.0277	$14\frac{1}{2}$	15.2679	2.5893			
15	12.5000	4.1666	15	15.1786	2.6786			

## GRAIN AND COMMISSION

### CEREAL AND FLOUR BILLING

The following illustrates some of the "Billing Work" extensions found in Cereal Mfrs.' offices.

**EXAMPLE:**

250 Bags (240 lbs. each) Rolled Oats at \$3.40 per bbl. of 180 lbs.

**METHOD**

A bag contains 240 pounds, while the basis for price is 180 lbs.

The unit of weight per bag is therefore  $133\frac{1}{3}\%$  that of the price unit.

**Use the Fixed Decimal.**

Take this  $\%$  as a constant factor.

Multiply the number of bags by the price and this result by 1.3333.

$$3.40 \times 250 = \$850.00$$

Leave the \$850.00 in the machine and **increase it by  $33\frac{1}{3}\%$**  thus—

Hold the key position on \$850.00 directly over itself.

Move to the right one place for the first decimal .3 and multiply respectively .33333 times.

Answer \$1133.33.

**EXAMPLE:**

120 Bags of Oatmeal (112 lbs. each) at \$2.30 for 280 lbs.

**METHOD**

The units of **weight per bag and price** are constant; therefore divide the pounds per bag by

the pounds per unit of price to get one constant factor.

$$112 \div 280 = .4$$

Use the Fixed Decimal.

Bags  $\times$  price  $\times .4$  = amount of Invoice.

$$120 \times 2.30 = 276.00$$

Now we want .4 of 276.00.

Leave \$276.00 in the machine and multiply by 4 (from the left) and point off one place = 110.40.

Or,—

Hold 276 for Key Position, multiply by 4 and point off one place. (As 276 is in the Register once, multiply it three times.)

**EXAMPLE:**

150 sacks of Jute, 60# each, @ \$5.30 for 210 lbs.

$$60 \div 210 = .2857$$

and use this as a constant factor—

$$150 \times .2857 \times 5.30$$

Use the Fixed Decimal for first extension. Three factor multiplication for the second = \$227.13.

**Barley.**

**EXAMPLE:**

150 sacks Pot. Barley (98# per sack) at \$2.20 cwt. = \$323.40.

100 sacks Pot. Barley (49# per sack) at \$2.30 cwt. = \$112.70.

Use 3 Factor Method with the foregoing.

Multiply the number of sacks  $\times$  unit weight  $\times$  price.

$$150 \times 98 \times 2.20 = \$323.40$$

$$100 \times 49 \times 2.30 = \$112.70$$



## A CLAIM AGAINST THE RAILROAD

Claims against the Railroads are frequently owing to loss of grain through defective cars, and grain stolen.

## EXAMPLE:

M. P. R. R. CO. 6-27-10

To M. and H. Co.

3/26—#124825 S. F. Bulk Rye.

Omaha to Louisville.

OMAHA WT	80000#
LOUISV WT	77580

2420

100

2320# or

41 bu. 24 lb. at 81½c E. St. L. . . . . 33.76

Plus freight at 8c. . . . . 1.86

35.62

The difference between the amount shipped and that received is determined 2420#

## METHOD

Add in the Comptometer the original weight . . . . .	80000#
Subtract the amount received . . . . .	77580
Equals Gross Loss . . . . .	2420#

Deduct ⅛th of 1% for "Invisible Loss" . . . . .	100
Leaves the Net Loss . . . . .	2320#

Reduce to bushels dividing by 56 equals. . 41 bu. 24 lbs.

41 bu. 24 lbs. at 81½c, (Using Grain Table for the decimal) equals. . . . . \$33.76

The freight having been paid on the original weight, the freight on the loss must be added to the claim.

Figure the freight, 2320#, at 8c equals. . 1.86

and add to grain loss . . . . . \$35.62

This ⅛th of 1% Invisible Loss is claimed by the Railroad as a natural wastage which must be deducted before any claim is made.



## DRUGS AND CHEMICALS

The Drug and Chemical business requires a great deal of adding every day.

We know the Comptometer is absolutely the most efficient **adding machine** made.

The outbiling has an occasional extension that needs to be figured. This, with the adding and proving of all invoices, soon makes the Comptometer indispensable on the Invoice Desk —

### BOOKKEEPING:

- Monthly Statements.
- Special Columns in Entry Books.
- Proving Daily Postings.
- Adding Salesmen's Expense Accounts.
- Figuring, Footing and Proving Payrolls.
- Balancing Ledger Accounts.
- Taking Off Trial Balance.
- Figuring Interest on Notes and Anticipations.

### PURCHASE DEPARTMENT AND CASHIER:

- Adding and Balancing Daily Cash Book.
- Adding Daily Sales and Vouchers.
- Adding Deposit Slips and Checks.
- Proving Extensions and Additions on Purchase Invoices, Freight Bills, etc.
- Figuring Discounts, etc.
- Footing Payrolls and Deposit Slips.

### COUNTRY AND CITY ORDER DEPARTMENTS:

(Usually these desks or departments are entirely separate).

- Extending quantities by Prices.
- Adding the Items on Original Invoices (also on Duplicate Invoices).
- Proving Additions and Extensions by Accumulating.

### COST DEPARTMENT:

- Figuring General and Departmental Costs and Profits.
- Footing and Cross Footing.
- Figuring Catalogue Prices to Make a Given Percentage of Profit.

### INVENTORY:

Figuring and Footing Inventory of Stock, (Handling Fractions, Both in Quantity and Price, as easily as Whole Numbers.)

### ANALYZING AND FORMULA WORK:

- Figuring Quantities in Pounds, Ounces, Grains, Drams, etc.
- Figuring the Cost of same.
- Adding Quantities, etc.

### CITY AND COUNTRY DEPARTMENT ORDER ROUTINE:

Orders are received and written on order blank with copies for customers' invoice, duplicate invoice, and department use.

The order goes to the Stock Room to be filled, Then —

The Price Clerk fills in the Prices.

The Bill Clerk copies and foots the customers' invoice, and enters amount on both the original and duplicate (with Comptometer).

The Duplicate goes to Comptometer Operator for Accumulating and Footing.

This also proves against the Total on Original Invoice.

The Operator should Extend the Duplicate accumulatively.

## BOOKKEEPING

See "Bookkeeping" for general data on the Bookkeeping Work.

Efficiency in this Department must be given first thought.

Remember the extreme convenience of Comptometer operation. Reading the results directly after the key is completed is a wonderful aid to the bookkeeper. He soon becomes much more efficient and adds to his **Ability to Produce**.

The Comptometer Convenience, Placed Right Beside the Work, Lessens the Energy Expended, and Leaves a Fresh and Unwearied Bookkeeper.

### CITY AND COUNTRY ORDER DEPARTMENTS INVOICING

The following is representative of an invoice in either department. They will range from a few items to several sheets to an order:

JOHN JONES, DR., To CHICAGO DRUG & CHEMICAL CO., <span style="float: right;">September 7th, 1912.</span>					
Quantity	Article	Price	Unit	Gro. Ext.	Net Ext.
1 case	Crayons				\$ 9.50
10%	Boric Acid				1.35
2%	S. Acid	.35	lb.		.70
$\frac{1}{8}$ doz.	Terraline	9.00	doz.		1.50
4%	Methyl. Sal.	.65	lb.		2.60
5%	Nux Vom	.16 $\frac{1}{2}$	lb.		.83
					<u>\$16.48</u>

The Bill Clerk with the Comptometer at hand would use it to extend the last two items.

While they are easily figured mentally, it is very much easier to drop the fingers on the 65c keys and depress them 4 times. Again, to hold the .165 keys and depress 5 times without giving a thought.

The items will then be added.

For a Positive Proof, accumulate over the Fixed Decimal, adding in items that require no extensions and multiplying the others.

This method soon develops efficiency, while the Accuracy alone makes the Comptometer invaluable.

## WHOLESALE DRUG HOUSES

The following is a representative Drug Invoice. You will see that about 10 to 30% of the items can employ a Comptometer advantageously in extending.

NOTICE.—No claims allowed unless made within three days after receipt of goods. In shipping we do not guarantee safe delivery of goods, we take no return. IF GOODS ORDERED, and they are at consignee's risk after receipt are signed by transportation company. Pay no money in our agents' names by our order. Interest charged after maturity.



SALESMEN

*Meyer Brothers Drug Company*  
Importers, Jobbers and Manufacturing Chemists

SOLD TO

*Saint Louis, Mo*

TERMS

MISS ELLA ECKELKAMP,

ST. LOUIS, MO.

We do hereby guarantee that the goods and services of food, as ordered by the Buyer and shipped by the Seller, are of the quality, quantity and description as shown on the invoice or order by the Buyer and that the goods are delivered to the Buyer in the condition and quantity as shown on the invoice or order by the Buyer and that the goods are delivered to the Buyer in the condition and quantity as shown on the invoice or order by the Buyer.

M. B.—This bill is subject to the other Documents or Allowances of any kind except as herein specified. ©

1/2	DOZ	I-C-FACE POWDER WHITE 1415	2 00	1 00
1/2	DOZ	" " " FLESH " " " " " "	2 00	1 00
1/2	DOZ	" " " BRUNETTE " " " " " "	2 00	1 00
			3 00	
LESS 20% CONTRACT			60	
			2 40	2 40
1	CASE	SCHOOL CRAYONS STERLING 100 GROSS		9 50
10	#	ACID BORIC PURE POWD MB CTN	13 1/2	1 35
10	#	ENGL CALOMEL 1'S MB	95	9 50
10	#	IODIDE POTASH GRAN 1'S MB	1 92	19 20
1	#	PERMANGANATE POT CRYSTAL SC CTN		25
2	#	SULPHURIC ACID USP GSB MB INCL	35	70
2 1/2	OZS	MORPHINE SULPH 1/8-S MB	3 00	7 50
1/4	#	TR HOANGUAN PD&CO 45		1 16
1/6	DOZ	TERRALINE	9 00	1 50
1/2	DOZ	ARNOLDS WRITING FLUID 1/2 PT	1 40	70
1/2	DOZ	" " " " " PT	2 70	1 35
2	GRO	PILL BOXES 29	70	1 40
2	GRO	" " " #31	70	1 40
1	GRO	" " " ASST		70
2	CZS	CAFFEINE CITRATE OZS MB INCL	50	60
1/6	DOZ	GRAINS RX FILES 1M	8 40	1 40
1/2	DOZ	MENALLY MAPS OF TEXAS POCKET	1 60	80
1	#	TRUE WILLOW CHARCOAL RED DIAMOND CTN		20
1	#	HYPOSULPHITE SODA GRAN USP CTN MB		15
1	#	METHYL SALICYLATE CSB B		63
1/4	#	OIL BERGAMOT CSB B	5 00	1 25
1/2	#	" CLOVES B 6	1 42	71
1/2	#	" CASSIA CINNAMON USP BOTTLE 6	2 92	1 16
5	#	MUX VOMICA POWDERED BILK	16 1/2	83
1	DOZ	DOANS KIDNEY PILL		4 50
1	DOZ	MISSISSIPPI DIAR-CURE 2/-		2 00
1	DOZ	R&G RACE POWDER 7711 WHITE		1 80
1	DOZ	BICYCLE CARDS		1 80
1/2	DOZ	PACKER TAR SOAP	1 90	95
12	DOZ	BELL TOP THIN BLOWN SODA GLASSES 12 OZ 1 BBL	52	6 74
			1 BBL 50 CTS	
10	#	BOSS HOG CHOLERA MIXTURE POWD	06 1/2	65
1	DOZ	LYONS TOOTH POWDER		1 85
1	ONLY	GENERAL CATALOGUE		

55.65

It will save a little time and considerable of the clerks' "gray matter" and make for a greater degree of accuracy. The time saved and the relief to the clerks in extending and adding is clearly apparent to those familiar with Comptometers and will be to others after a degree of proficiency has been acquired.

## MINNEAPOLIS DRUG COMPANY

WHOLESALE

DRUGS, SUNDRIES AND CIGARS

Minneapolis, 11-1-12.

Yahr & Lange Drug Co.,  
Milwaukee, Wis.

Gentlemen:—

We are in receipt of yours of the 21st, inquiring as to what class of work we do with the Comptometers.

In reply, would say that we have three of them in use at the present time, two in connection with the extensions and footing of our country invoices and one for our city business.

While it is true that an extension clerk in our line can put down without computation probably 60 to 75% of the extensions, nevertheless, on the balance where computation is necessary, we find the Comptometer a great saver.

The system we now employ gives us an excellent check on our extensions and footings. The orders after being priced are handed to Comptometer Extensions Clerk No. 1 who carries out the extensions on the columns of the original order, putting in the footing on each sheet. After the work is done in this manner, the order is passed to Comptometer Clerk No. 2, who places a slip over the end of the original order sheet covering up the figures made by the first extender. She then carries out the extensions in a column provided on the slip and foots the same. The order and slip are then turned over to our bill checker, who verifies the footings and extensions. In this way, we have a double check on all country extensions, and we find the two girls working with Comptometers can handle the business which would have taken three, or possibly four, extension clerks to handle under the old system, and we think we are getting much better and more accurate results. We have one young lady operator at the city desk, who takes all the bills from the city pricer and extends and foots them.

We were skeptical for a long time as to whether this machine would work in our business, but we have given it now a trial for nearly 18 months, and would not think of being without them.

Yours truly,  
SAD:C. Minneapolis Drug Company.

## SOME ITEMS OF EXTENSIONS FOUND IN PURCHASE AND OUT INVOICES

## BOILED AND LINSEED OIL

## EXAMPLE:

1 bbl. B. Oil 475 lbs., tare 63 lbs., at \$1.05 a gal.  
The oil weighs  $7\frac{1}{2}$  lbs. per gal.

## METHOD 1

The usual method would be—

Gross weight.....475 lbs.

Less the tare..... 63 lbs.

Net weight .....412 lbs.

Net weight divided by  $7\frac{1}{2}$ —

$412 \div 7\frac{1}{2}$  ..... 54.93 gals.

## METHOD 2

The shorter way is:

Add the gross weight on Comptometer...475

(on the three black columns of keys)

Deduct the tare..... 63

412

Add  $\frac{1}{3}$  to this and point off one place....137.3

54.93

54.93 gals. at \$1.05 equals.....\$57.68

A good way to add the one-third is to hold the net weight keys 412 directly over itself. Then move to the right one place and multiply by .333 respectively, multiplying towards the right.

(The Reciprocal for  $7\frac{1}{2}$  is  $.133\frac{1}{3}$ )

Leaving the 412 in the machine, multiply by .1333, i. e., holding the 412 keys directly over itself. It is already multiplied by 1, so move one place to the right and multiply by 333 to the end of the keyboard and point off one more decimal.

The Comptometer figures the above in one continuous operation.

## ALCOHOL

Grain alcohol and denatured alcohol are sold by the gallon and barrel, the latter usually of  $31\frac{1}{2}$  gallons.

47.7 gals. at \$3.16 equals.....\$150.73

## OTHER CHEMICALS

Some chemicals are measured in ounces and drams. The prices per pound or ounce (16 drams to the ounce).

## EXAMPLE:

13 oz. 7 dr. at \$1.45 lb.

2 lbs. 7 oz. 14 dr. at 96c lb.

6 oz. 3 dr. at \$1.75 oz.

Read from the ounce and dram table the **Decimal of a lb.** of any number of ounces and drams, or the **Decimal of an ounce** for any number of drams.

## METHOD

Use the Fixed Decimal.

Hold the Price Keys, \$1.45.

Move to the ~~left~~ <sup>right</sup> one place for the ~~tens~~ figure of the quantity. Multiply towards the right.

$1.45 \times .8398$  (decimal of a lb.) = \$1.22

$.96 \times 2.4922$  " " = 2.39

$1.75 \times .3867$  " " " = .68

**SODA ASH**

The Standard strength of Soda Ash is 58%, while the price is based on 48%.

Example :—

Quantity	Test	Descr.	Gro. Wt.	Tare	Net Wt.	Price
6 Bbls.	58%	Soda Ash 1938	120	1818	\$1.35 cwt.	
		of 48% strength,				\$29.66

**METHOD 1**

Add the gross weight in the Comptometer on the right	1938
Deduct the Tare .....	120
Equals the actual net weight .....	1818
Multiply by 58% .....	.58
Equals the net of strength .....	1054.44
Divide by 48 .....	48 ) 2197
Equals equivalent at \$1.35 cwt. ....	2197
Value .....	\$29.66

As the Soda Ash is of greater strength than that on which the price is based, it is obvious that the scale weight represents a correspondingly greater amount at the price stipulated, or that the price for the 58% must be correspondingly higher.

58% divided by 48% equals 120.833%, the per cent of the scaleweight which this higher test represents.

Use this as a constant factor.

**METHOD 2**

Multiply the net weight .....	1818
by the % 1.20833 equals .....	2197
Multiply by the price per cwt. ....	1.35
Equals the value .....	\$29.66

**METHOD 3**

If figuring a number of these bills at the same price.

Multiply this per cent by the price and establish a constant factor, which needs only be multiplied by the scale weight to give the correct results.

$1.35 \times 1.20833$  equals 1.6312 as a constant factor.

Then

Net weight 1818 @ \$1.6312 cwt. equals \$29.66.

The 10 or 12 column Comptometers give the better service on this work.

**ROSIN**

EXAMPLE :

615-lbs. Rosin at \$8.05 per bbl. of 280-lbs. equals \$17.68.

**METHOD**

$615 \times 8.05$  equals \$4950.75, divided by 280 equals \$17.68.

If extending a number of invoices at the same price, it is even better to get one constant factor or price per lb., i. e.

$8.05$  divided by 280 equals .02875 per lb.

Hold the weight for multiplier keys.

Use the Fixed Decimal.

$615 \times .02875$  equals \$17.68.

**GROSS TON**

In the following problem the quantity is in pounds, while the price is by the Gross Ton. A percentage is deducted for Moisture Test.

6,847,250 lbs. less .002% Moisture Test at \$5.928 per Gross Ton.

Less freight at .1187 cwt.

**METHOD**

First extend the Freight.

$6,847,250 \times .1187$  equals \$8127.68.

Then multiply the quantity by the NET of Moisture Test.

$6,847,250 \times .998$  equals 6,833,555 lbs. net.

Leave this net weight in the machine, and Divide by 2240 equals 3050.694 Gross Tons.

3050.694 @ \$5.928 . . . . . \$18,084.51

Multiply from the left. Use the price for key factor and split.

Less Freight . . . . . 8,127.68

Equals Net . . . . . \$ 9,956.83

# OUNCES AND DRAMS REDUCED TO DECIMALS OF A POUND

## EXAMPLE:

6 lbs. 11 ounces and 13 drams @ 34c per lb.

## METHOD

Looking at the Table at the junction of 11 ounces and 13 drams, we find this quantity equals .7383 of a pound. Therefore, hold, over the Fixed Decimal, 34 for Key Factor, and multiply, towards the right, 6.7383, equals \$2.291022.

OUNCES AND DRAMS REDUCED TO DECIMAL OF A POUND																	
Drams	OUNCES																Drams
		1 oz.	2 oz.	3 oz.	4 oz.	5 oz.	6 oz.	7 oz.	8 oz.	9 oz.	10 oz.	11 oz.	12 oz.	13 oz.	14 oz.	15 oz.	
		.0625	.125	.1875	.25	.3125	.375	.4375	.5	.5625	.625	.6875	.75	.8125	.875	.9375	
1	.0039	.0664	.1289	.1914	.2539	.3164	.3789	.4414	.5039	.5664	.6289	.6914	.7539	.8164	.8789	.9414	1
2	.0078	.0703	.1328	.1953	.2578	.3203	.3828	.4453	.5078	.5703	.6328	.6953	.7578	.8203	.8828	.9453	2
3	.0117	.0742	.1367	.1992	.2617	.3242	.3867	.4492	.5117	.5742	.6367	.6992	.7617	.8242	.8867	.9492	3
4	.0156	.0781	.1406	.2031	.2656	.3281	.3906	.4531	.5156	.5781	.6406	.7031	.7656	.8281	.8906	.9531	4
5	.0195	.0820	.1445	.2070	.2695	.3320	.3945	.4570	.5195	.5820	.6445	.7070	.7695	.8320	.8945	.9570	5
6	.0234	.0859	.1484	.2109	.2734	.3359	.3984	.4609	.5234	.5859	.6484	.7109	.7734	.8359	.8984	.9609	6
7	.0273	.0898	.1523	.2148	.2773	.3398	.4023	.4648	.5273	.5898	.6523	.7148	.7773	.8398	.9023	.9648	7
8	.0313	.0938	.1563	.2188	.2813	.3438	.4063	.4688	.5313	.5938	.6563	.7188	.7813	.8438	.9063	.9688	8
9	.0352	.0977	.1602	.2227	.2852	.3477	.4102	.4727	.5352	.5977	.6602	.7227	.7852	.8477	.9102	.9727	9
10	.0391	.1016	.1641	.2266	.2891	.3516	.4141	.4766	.5391	.6016	.6641	.7266	.7891	.8516	.9141	.9766	10
11	.0430	.1055	.1680	.2305	.2930	.3555	.4180	.4805	.5430	.6055	.6680	.7305	.7930	.8555	.9180	.9805	11
12	.0469	.1094	.1719	.2344	.2969	.3594	.4219	.4844	.5469	.6094	.6719	.7344	.7969	.8594	.9219	.9844	12
13	.0508	.1133	.1758	.2383	.3008	.3633	.4258	.4883	.5508	.6133	.6758	.7383	.8008	.8633	.9258	.9883	13
14	.0547	.1172	.1797	.2422	.3047	.3672	.4297	.4922	.5547	.6172	.6797	.7422	.8047	.8672	.9297	.9922	14
15	.0586	.1211	.1836	.2461	.3086	.3711	.4336	.4961	.5586	.6211	.6836	.7461	.8086	.8711	.9336	.9961	15



## FORMULA WORK

**Determining:** The Quantity of each Ingredient;  
 The Grains in each Tablet;  
 The Number of specified Tablets that  
 can be made from a given quantity;  
 The Cost Work, etc.

The Comptometer becomes a favorite wherever given  
 a thorough trial on this work.

### EXAMPLES:

An order for 25,000 tablets; each to contain:

1 3/10	Grains of	A
3 2/10	"	B
1/4	"	C
7/16	"	D

**Wanted:** Quantity of each Ingredient required for  
 the order.

### METHOD

Use the Fixed Decimal; Multiply the grains in each  
 tablet by the number of tablets, i. e.—

1 3/10	×	25000	=	32500	Grains of	A
3 2/10	×	25000	=	80000	"	B
1 1/4	×	25000	=	31250	"	C
7/16	×	25000	=	10937	"	D

6 3/16	154687	"	TOTAL
--------	--------	---	-------

To Prove: Add the Unit Grains per Tablet,—equals  
 6 3/16. Multiply by 2500 equals 154687, proving against  
 the total of the separate ingredients.

### Reduce Grains to Pounds:

**45492 Grains equals how many Pounds?** (7000 Grains  
 equals one Pound.)

Add 45492 in the Register. Divide by 7000, using  
 the cipher method. (See Index for "Cipher Method  
 Division.") This delivers the quotient, 6 lbs., one place  
 to the left—with a remainder of 3492 grains.

Proceed directly to reduce this to ounces, i. e., divide  
 by 437.5. Read the entire answer in the Register—6 lbs.  
 7 ozs. 429½ grains.

### FORMULA WORK:

6500 tablets contain:

3 ounces	256 grains	of	A
2 "	137 "	"	B
	380 "	"	C

How many grains of each per tablet?

**Note the simple and speedy manner of producing the  
 results.**

Reduce the ounces to grains, preferably over the Fixed  
 Decimal.

$$437\frac{1}{2} \times 3 = 1312.5$$

Add the number of grains      256.

1568.5

Divide the grains by 6500 equals .2413 grains each of A.

Each ingredient is figured in the same manner:

.2413	A
.1557	B
.0584	C
.4554	

Prove each division. (See Index for "Proving Division.")  
 Or reduce all to grains over the Fixed Decimal.

Multiply the total ounces by the grains per ounce.

437½	×	5	=	2187.5
Add the grains				256
				137
				380

and divide this total by 6500)2960.5

equals .4554

Proving against the total of the ingredients.

### FIGURING FORMULA COST

The cost prices may be based on drams, grains, ounces or pounds.

**EXAMPLE:**

2 oz. 11 dr. at.....	24½c oz.
256 gr.       " .....	.85c lb.
3 oz. 7 dr.   " .....	1.45 lb.
16 gr.        " .....	1¾c gr.

### METHOD

Use the Fixed Decimal.

Hold the price keys.

Multiply towards the right.

Read the Decimals of a lb. from the Ounce and Dram Decimal Table.

First make extension on 256 gr. at 85c lb. *2*

256 × .85 equals

217.60

Leave this in the machine and multiply by .0023\*, reciprocal for 437½

.50

(3-factor multiplying page 39)

Clear the machine and add this result .50 in the **Fixed Decimal Position**.

Accumulate each of the other items over the Fixed Decimal, reading the Decimals of quantities from the Decimal Table.

\*The Reciprocal of 437½ is .0022857. But the 4th decimal place is enough for this work.  
An avoirdupois ounce contains 437½ grains.

## ELECTRICAL

### Where and How Time is Saved by the Comptometer on Electrical Accounting Work

#### BOOKKEEPING DEPARTMENT

Adding and Balancing Daily Cash Book  
 Adding Daily Sales and Vouchers  
 Adding Deposit Slips and Checks  
 Adding Monthly Statements  
 Adding Special Columns in Entry Books  
 Proving Daily Postings  
 Adding Bill Journal  
 Adding Power Sales Journal  
 Adding Light Sales Journal  
 Adding Salesmen's Expense Accounts  
 Balancing Ledger Accounts  
 Taking off Trial Balance  
 Figuring Interest on Notes and Anticipations  
 Proving Customers' Discounts Deducted in Settlement

#### BILLING DEPARTMENT

Figuring all Extensions by Piece, Dozen, Gross or Yard  
 Footing all Invoices  
 Proving all Extensions and Footings  
 Figuring Discounts  
 Figuring Tonnage, etc.  
 Extending and Subtracting Freight Rates  
 Summarizing Sales

#### COST DEPARTMENT

Adding Time Slips per Departments and Jobs  
 Verifying Extensions on Time Slips  
 Adding Cost, Sales and Profit per Department  
 Verifying Extensions on Material Slips  
 Figuring Percentages of all kinds  
 Figuring Averages  
 Prorating  
 Figuring Cost of Various Operations on each Piece of Work  
 Making up catalogue prices

#### TIME-KEEPING

Figuring and Verifying Time Cards  
 Adding Hours and Minutes  
 Extensions on Payrolls per Day, Hour, Piece, Hundred, etc.  
 Totaling Payrolls  
 Figuring Averages and Rates per Hour  
 Adding Recapitulations  
 Finding Coin and Currency required for each Denomination.

#### STORE-ROOM

Figuring and Proving Daily Labor Requisitions  
 Figuring and Proving Daily Material Requisitions  
 Adding and Cross-Adding the Distribution  
 Extending and Adding Inventories  
 Figuring Unit Prices

#### STATISTICAL DEPARTMENT

Adding Kilowatt Hours  
 Figuring Percentages  
 Averaging Hours per Day of Light Consumed, etc.

#### SUPERINTENDENT'S OFFICE

Adding Load Records  
 Adding Purchase Slips  
 Figuring Average Loads  
 Figuring K. W. Hours  
 Figuring Averages per Hour  
 Additions of Public Service Commission Reports  
 Addition of Classified Service Consumptions, etc.  
 Figuring Payrolls

A comprehensive knowledge of costs can be obtained with the Comptometer without increasing the expense of this service. The Comptometer is paying for itself times over on this work alone in many offices.

### ESTIMATES

The Comptometer will be found useful in figuring and proving the extensions and totals on Estimate Sheets, covering material and labor for wiring and installing motors and similar work. These estimates are about as follows:

ESTIMATE SHEET				
Job for WILLIAM JAMES, 13 MAIN STREET, CITY				
BASEMENT				
		Unit Cost	Material	Labor
12	No. 7 Outlets	\$ .60	\$ 7.20	\$ 4.20
6	No. 01 Brackets	.15	.90	.35
2	No. 1218 Swithes	1.50	3.00	1.25
1	No. 12 Base Switch	3.00	3.00	.65
22	Lights, Hylø	.32	7.04	.20
1	G. E. 12 H. P. Motor	165.00	165.00	12.50
			Material \$186.14	\$19.15
			Labor 19.15	
\$205.29 Total Cost				

#### METHOD 1

If each individual extension is required in the above—

The labor is at a fixed price for each piece of work.  
Extend the material and labor;

Add the material and labor columns and get the total cost for the job;

Prove both material and labor totals by extending accumulatively.

#### METHOD 2

If only the total of each class is required—

Accumulate the material extensions and then

Accumulate the labor extensions.

Prove in the same manner.

If the estimate sheets contain a large number of items, it is well to set down a total for each 15 or 20 items.

## SOME EVERY-DAY WORK IN THE ELECTRICAL LINES

175' 1" Conduit Black	@	\$21.00 C	
50-10-10-10-5%			\$12.73
8— $\frac{1}{4}$ " H.P. 120 Volt Motor Starters	@	5.00 ea.	
40-2 $\frac{1}{2}$ %			23.40
167 Carbon Brushes	@	10.50 C	17.54
500' #14 D. B. R. C. Wire	@	22.30 M	
50%			5.58
			<hr/>
			\$59.25
Less 2%			

Less 2%

21' 11" of 6" 4-ply Woven Belting @	.62 per ft.	
60-10-5%		\$ 4.65
175' 5/8" Rubber Tubing @	.28	
50-15%		20.83
		<hr/>
		\$25.48

**Manufacturers** have to figure efficiencies on Transformers at various loads. The Comptometer simplifies and reduces this work to a minimum.

## FIGURING TRANSFORMER EFFICIENCY

## THE OLD WAY

Kilo Copy.  
 2800

Copper Loan  
 42

Copper Loan  
 55

Full Loan

42  
 55  
2500  
 2597 25000 (96.26 - full loan)  
 32273  
 26.62  
 24.76  
 55  
 16.485  
 57  
 34 of 25000 = 1875

1875  
 18750 (96.25 = 3/4 loan)  
 17532  
 11688  
 4820  
 3896  
 10240  
 9740  
 500

1/2 Loan

(1/2)<sup>2</sup> = .25

55  
 25  
275  
 110  
1375

1306 12500 (96.71)  
 11754  
 7460  
 6530  
 9300  
 9142  
 1680  
 1306

2800  
 .5  
125.00

The above method of figuring involves the setting down of all these figures and takes anywhere from 1½ to 3 minutes to get the two results.

## THE COMPTOMETER WAY

<u>Kilo Capy.</u>	<u>Core Loss</u>	<u>Copper Loss</u>	<u>Full Load</u>	<u><math>\frac{3}{4}</math> Load</u>	<u><math>\frac{1}{2}</math> Load</u>
2500	42	55	96.26	96.25	95.71

### METHOD FOR FULL LOAD EFFICIENCY

Add the Core Loss .....	42
Add the Copper Loss .....	55
Add the Kilo Cap'y .....	2500
	<u>2597</u>
Divide this total into the Kilo Capacity	
= The Full Load Efficiency .....	96.28 %

## FOR $\frac{3}{4}$ LOAD EFFICIENCY

Square the Efficiency—	
$\frac{3}{4} = .75 \times .75 =$	.5625
Accumulate the following, using the Fixed Decimal:	
Add in the Core Loss	42
Multiply Copper Loss by the Square of the Efficiency,	$55 \times .5625$
Multiply the Kilo Cap'y by the Efficiency, i. e., $2500 \times .75$	
	1947.9375
Divide this accumulated result into three-quarters of the	
Kilo Cap'y $2500 \times .75$ .....	1875
$1875 \div 1948 =$	.96.25%

## FOR ½ LOAD EFFICIENCY

Square  $\frac{1}{2} = \frac{1}{4}$ , or .25 and proceed on same principle as for  $\frac{3}{4}$  load,  
i. e., Accumulate.—Core Loss, Copper Loss by Square of Effi-  
ciency, Kilo Cap'y by Efficiency ..... 1305.75  
1250 ÷ 1306 ..... 95.71%

The results direct from the original data—prove them with absolute accuracy, in less time than it takes to figure them once the old way—all without setting down a single figure except the answers.

## MONTHLY SUMMARY—ELECTRIC LIGHT COMPANIES

Electric Light Companies work up a monthly summary of output, losses, consumption, coal consumption, etc.

They want the percentage of every item of loss and consumption to each of the basic factors—

A—Total Electricity Generated.

B—Station Output.

C—Total Electricity Sold.

EXAMPLE:

SUMMARY OF OUTPUT, LOSSES, ETC.				
	K. W. H.	% of "A"	% of "B"	% of "C"
<b>"A" Total Generated</b> .....	442160			
Commercial Output .....	320076	72.4	83.9	99.1
Arc Output .....	61640	13.9	16.1	19.1
<b>"B" Station Output</b> .....	381716	86.3		
Station Loss .....	60444	13.7	15.8	18.7
Loss—Accounted for .....	40560	9.2	10.6	12.6
Loss—Unaccounted for .....	19884	4.5	5.3	6.1
Loss—Exitation .....	26190	5.9	6.9	8.1
Loss—Syn. Motor Set .....	14370	3.2	3.8	4.5
Loss—Transformer .....	19647	4.4	5.1	6.1
Loss—Meter .....	9063	2.0	2.4	2.8
Loss—Unaccounted for Line .....	19329	4.4	5.1	6.0
Office Lighting .....	3181	.72	.83	1.0
Office Elevator .....	305	.07	.08	.09
Sign, Talking .....	92	.02	.02	.03
Sign, Office .....	456	.10	.12	.14
Machine Shop .....	4444	1.01	1.16	1.37
Ashes Elevator .....	95	.02	.03	.03
Automobiles .....	1307	.30	.34	.40
Used by Employees .....	936	.21	.25	.29
<b>Total</b> .....	10816	2.45	2.83	3.35
Losses on Comm. Ckts. ....	48039	10.9	12.6	14.9
<b>Total used by Company and Empl. and Losses</b> .....	58855	13.3	15.4	18.2
<b>"C" Total Sold</b> .....	322861	73.	84.6	

NOTE:—For convenience, business houses generally employ the decimal point in percentages two places to the right of its true decimal value.

## METHOD 1

Divide every item by Basic Quantities "A," "B" and "C" to determine the percentage relation of each of these items to the Basic Factors, i. e.,

Put one of the Dividends of the highest denomination in the machine from the left.

Turn down the original decimal in the Dividend, and hereafter put all Dividends in with the same decimal position.

Turn down the decimal pointer as it will be in the result, i. e., there being six whole places in the Divisor 442160, the decimal in the result will be six places to the left of the original decimal. There are only three places required in the per cents, so turn down another decimal pointer at the right of the third answer place.



The first Divisor is 442160, but as only three places are required in the answer, use only the first four places of the Divisor, as 4 4 2 2.

Divide until you have produced the **third Quotient Figure**; answer .723 and remainder 3654.

The remainder being more than one half the Divisor, jot down the first per cent as 72.4

## TO PROVE THE DIVISION

Jot down the Quotient Figures and Remainder, 723-3654;

Clear the machine;

Multiply the Quotient by the Divisor,

$$-723 \times 4422 = 3197106;$$

Add in the remainder . . . . . 3654

Equals the original Dividend . . . . . 3200760

Or

When the division is completed and the Register shows —

723<sup>v</sup> 3654

Subtract out the Quotient 723;

Multiply the Quotient by the Divisor, directly over the Remainder, i. e., taking the Key Position on 723 directly over the Remainder  $723 \times 4422$

3654

Add the next Dividend in the machine with the Unit Figure in the same column as before. This leaves the decimal at the same place and assures you of reading the correct per cent without pointing off each time.

Divide by 4422. Stop when you have produced the **Third Quotient Figure**, 139. The Remainder, 1742, being less than one half the Divisor, jot down this per cent as 13.9%.

To prove, subtract out the 139.

Take the Key Position on the Quotient, 139, over the right end of Remainder . . . . . 139  
1742

and multiply by 4422, multiplying toward the left = the Dividend, 61640.

Continue in this manner until each per cent has been determined.

**METHOD 2****SHORTER THAN METHOD 1**

As there are a number of divisions required with each Divisor, it is better to find the Reciprocal of each. (See Index for "Reciprocal Work.")

Divide 442160 into 1 = 22616+ as 2262,

" 381716 " 1 = 26197+ " 262,

" 322861 " 1 = 30975+ " 3097

Multiply each item by these Reciprocals for their respective per cents. Use only the first four places of the Reciprocal.

Multiply from the left of the Keyboard.

Prove each per cent by multiplying back negatively. (See Index for "Proving Multiplication By Negative Method.")

$$320076 \times 2262 = 72.4\% +$$

Or,

Fix the decimal when multiplying the Reciprocal by the largest Dividend and then multiply the other Dividends with the corresponding denominations in the same columns. This will leave all the decimals in the same place and eliminates pointing off for each per cent.

$$61640 \times 2262 = 13.9\% +$$

**COAL CONSUMPTION**

Total Amount of Coal Burned . . . 1,681,400 lbs.

1st. Find the Total Cost of Coal @ \$2.55 Gross Ton.

$$\frac{1,681,400 \times 2.55}{2240} = \$1914.09$$

2nd. Find the pounds of Coal used per K. W. Hour generated.

1,681,400 lbs. ÷ 442,160 K. W. H. generated = 3.80 lbs.

Per Station Output,

1,681,400 lbs. ÷ 381,716 . . . . . = 4.41 "

Per Total Sold,

1,681,400 lbs. ÷ 322,861 . . . . . = 5.21 "

Use only the first four figures of each Divisor.

Or better,

Multiply the Total Pounds of Coal by the Reciprocals previously determined.

$$\begin{aligned} 1,681,400 \times 2262 &= 3.80 \\ &\times 262 = 4.41 \\ &\times 3097 = 5.21 \end{aligned}$$

3rd. Find the Cost of Coal per K. W. Hour for each of above items.

The Cost of 1 lb. is  $\frac{255}{2240}$  or .001138

K.W.H. Generated cost 3.8 × .001138 = .0043

" Station Output Cost 4.4 × .001138 = .0050

" Total Sold " 5.21 × .001138 = .0059



## FUEL RECORD

Electric and Gas Lighting and Power Plants keep a Daily Fuel Record.

From this data of Coal Consumption and that of the Product, they work up an analytical and comparative statement.

There is considerable Comptometer work in gathering the data for the Fuel Record, such as:

Adding Quantities of Coal Unloaded,  
 " " " " Consumed,  
 " to and Deducting from Coal  
 in Bunkers,

to determine quantity on hand, etc.

On the Daily Fuel Record is:

The Cross-Adding of Quantities in each  
 Team of Units,  
 The Cross-Adding of Quantities in all  
 Units for the Total of Each Item.

Dividing to obtain such information, as,

The Pounds of Coal per K. W. H. for the day,  
 " " " " " " " " year  
 to date,

The Percent of Ash in the Coal,  
 " Pounds of Ash per K. W. H.



The above illustrates in a general way the data usually required in this record.

## POWER FACTOR RESULTS

Some Electric Companies charge only for the kilowatt hours used and grade the rates according to the current used and subject to special discounts, as

53 Kilowatt Hours	@	12c
105     "     "	@	7c
216     "     "	@	6c
		<u>\$26.67</u>

In fixing the monthly charges to consumers of electric current, the service meters register continuously the amount of current consumed, while the M. D. meters register the Maximum Demand, or current peak.

The consumption varies. It may be 7 kilowatts today and 8.9 K.W. tomorrow. The maximum demand, or requirement, at any time represents the amount which the Power Company must be ready to furnish at all times. They, therefore, make a flat charge for such service. In the example shown, the highest demand during the month was 8.9 K.W. and the fixed charge is \$3.00 per month per K.W. Then, an additional charge is made of 5c per K.W. Hour, subject to discounts.

Electric Power Companies in the West have problems like the following:

$$\begin{aligned}
 (3.00 \times 8.9) + (2955 \text{ KWH} \times 5c) &= 174.45 \\
 \text{Less } 21\% &= 137.816 \\
 \text{Less } 20\% \text{ on all over } \$100.00, \\
 \text{and less } \$5.00 &= 125.25
 \end{aligned}$$

The Comptometer is extremely efficient on this work and is very easy to learn. We give two methods of getting the results wanted.

The first entails one canceling of the machine.

The second arrives at the result **without clearing** and is preferable where there is considerable of this work.

### 1ST METHOD

$$\begin{array}{rcl}
 \text{Accumulate with decimal between the two white} \\
 \text{and three black keys—} & 3.00 & \times 8.9 \\
 & 2955 \text{ KWH} & \times .05 \\
 & & \hline
 & & 174.45
 \end{array}$$

Leave this in the machine and multiply by the net of the discount 79—(keys of 78 from left of amount. See p. 39) and point off two more places.....137.8155

Clear the machine.

$$\begin{array}{rcl}
 20\% \text{ discount on } 37.815 \text{ equals } 80\% \text{ net;} \\
 \text{therefore, multiply } 37.815 \text{ by } 80\% \\
 (37.815 \times 80) = & & 30.25 \\
 \text{Add in the } 100 & & 100.00 \\
 & & \hline
 & & 130.25 \\
 \text{Subtract out the } & & 5.00 \\
 & & \hline
 & & 125.25
 \end{array}$$

Or,

After taking off the first discount and the Register shows.....137.8155

Multiply 80% by 37.8155 over the present decimal, i. e., take Key position on .8 (over the 8 in Register). Move one place to the left. There multiply three times, continuing toward the right, by 7 8 1 5, respectively.. 168.067  
 Subtract out 37.815 + 5.00..... 42.815 = 125.252

## LIVE STOCK COMMISSION BROKERS

Live Stock Brokers have splendid use for the Comptometer.

As a rule, figuring Scale Tickets, making out Account Sales, Drafts, etc., has to be done in a hurried manner. The Comptometer thus becomes of **exceptional assistance** in producing **quick and accurate results**.

The principal uses are:

Figuring and Proving Scale Tickets.

" Invoices.

" Account Sales and Making Deductions.

Prorating Freight Charges, etc.

Totaling Ledger.

" Draft or Check Register.

Proving Daily Postings.

Taking Trial Balances, etc.

## LIVE STOCK COMMISSION ROUTINE

- 1st. Railroad Company delivers cars of Live Stock to Stock Yards Companies' transfer.
- 2nd. Stock Yards Co. distributes throughout yards to the pens of Commission Companies, to whom it is consigned.
- 3rd. Commission firms give Stock Yards Co. receipt for delivery.
- 4th. Commission firms sell to packers or individuals.
- 5th. The stock is fed and watered.
- 6th. Weighed by the Stock Yards Co.
- 7th. Stock Yards Co. issue weight ticket to Commission firms.
- 8th. Commission Companies figure these tickets on Comptometers, placing the amount on the back of the ticket.

Prove by multiplying negatively or refiguring.

Make out invoice for the **purchaser**.

Invoice proven on the Comptometer.

Make out Account of Sales for **shipper**.

This latter gives the number of head in the shipment, price sold at and amount received.

Deductions: { yardage charge  
feeding  
freight  
commission

This is done on Comptometer and draft for the balance is sent the shipper.

### FIGURING AND PROVING SCALE TICKETS

Scale Tickets are made out in duplicate by the Weigh Master at the Yards. They show the number of head and the weight in pounds. They are turned over to the Commission Agent who has sold the stock. He prices same, figures the extensions and makes out a sales invoice for the buyer. The carbon copy of the Scale Ticket is attached to the sales invoice and the original retained for his own records.

Prior to the introduction of the Comptometer Method, the custom of the Live Stock Broker had been to figure the extensions, making any deductions, etc., on the back of the Scale Ticket. Another person checked over the same pencil figures, or, in some cases, refigured independently and compared the answer.

The following is a typical

#### SCALE TICKET

UNION STOCK YARDS CO. OF OMAHA (Limited)															
SOUTH OMAHA, NEBRASKA. NO. ....															
From <i>Thiet</i>															
To <i>Cressery</i>															
<i>25</i> Cattle		<i>24180</i>	lbs												
Hogs			lbs.												
Sheep <i>Push 535</i>			lbs.												
<table border="1"> <thead> <tr> <th colspan="2">TAKEN FROM</th> <th colspan="2">YARDED IN</th> </tr> <tr> <th>BLOCK</th> <th>PEN</th> <th>BLOCK</th> <th>PEN</th> </tr> </thead> <tbody> <tr> <td><i>44</i></td> <td><i>12</i></td> <td></td> <td></td> </tr> </tbody> </table>		TAKEN FROM		YARDED IN		BLOCK	PEN	BLOCK	PEN	<i>44</i>	<i>12</i>			<i>1-26 1912</i> <i>Fitzgerald</i> Weighmaster	
TAKEN FROM		YARDED IN													
BLOCK	PEN	BLOCK	PEN												
<i>44</i>	<i>12</i>														
Scale No. <i>10</i>		<i>179363</i>													

#### COMPTOMETER METHOD No. 1

The weight is multiplied by the price and the amount jotted down on the face of the Scale Ticket.

The machine is cleared and same extension re-figured and, the answers corresponding, the amount is check-marked on the Scale Ticket.

#### COMPTOMETER METHOD No. 2

Multiply the weight by the price and jot the amount on Scale Ticket.

Leave this amount in the machine and multiply the weight by the price negatively equals the original weight, thus proving the original answer.

**LIVE STOCK COMMISSION**

Several owners will combine in shipping a car of live stock to a Broker. The Broker receiving and selling it must divide the freight proportionate to the net weight for each owner.

**PRORATING FREIGHT CHARGES****EXAMPLE:**

Jones	12320#	Cattle	Freight \$87.56
Smith	28840#	"	
Brown	1300#	"	
	<u>42460#</u>		

Total net weight, 42460 lbs.

Total amount of Freight, \$87.56.

Determine the rate of freight per cwt.

42460 divided into \$87.56 equals \$.2062 cwt.

This rate multiplied by the net weight received from each owner equals his portion of the freight.

.2062	×	123.20	\$25.41 Jones
	×	288.40	59.47 Smith
	×	13.00	2.68 Brown
			<u>\$87.56</u>

**METHOD**

1st. Add the weight.

2nd. Divide the weight into the amount of freight to determine the rate per cwt.

3rd. Extend the quantity for each owner by the rate per cwt.

4th. Add the amount and prove against the total freight.

This work requires:

Adding  
Multiplying  
Dividing

## LIVE STOCK COMMISSION INVOICE

## INVOICE

**THUET BROS. & MELADY**  
EST. 1887

**LIVE STOCK COMMISSION MERCHANTS**

South Omaha      CHICAGO      South St. Paul  
Rooms 204, 206 and 208 Exchange Bldg

Long Distance Phone      Long Distance Phone  
Bolt, Douglas 483      Independent 51

SOLD TO Cressey      South Omaha, Neb., 1-26-12

	CATTLE	HOGS	SHEEP	WEIGHT	OFF	PRICE	AMT	TOTAL
	25			24180		53.5	1293.60	
	18			20720		53.0	1098.40	
								2392.00

The extensions are made by multiplying the weight by the price and proven by re-multiplying or multiplying negatively. Where several lots or purchases are involved, it is better to make the proof by accumulative multiplication.

## METHOD

- 1st: Extend each weight by its respective sale price;
- 2d: Add the extensions for gross amount;
- 3d: Add the number of pounds of Hay and add the weights;
- 4th: Extend the Freight and Commission items;
- 5th: Add the expense items, such as Yardage, Hay, Commission, etc., and deduct from the gross amount, which gives the net proceeds, or amount of remittance to shipper.

## ACCOUNT SALES

**THUET BROS. & MELADY**  
ESTABLISHED 1887

**Live Stock Commission Merchants**

CHICAGO      SOUTH OMAHA      SO. ST. PAUL  
Using Stock Yards, Chicago, 1-26-12

Sold for Account of Joseph Bush      C. Neal Nelson

PURCHASER	Cattle	Hogs	Sheep	Weight	Off	Price	AMT	TOTAL
Lorway	25			24180		53.5	1293.60	
				20720		53.0	1098.40	
								2392.00
								611.75
								1075
								8.00
								21.50
								21.50

Freight and Delivery Charges, including Post on cash  
Bills at 4 1/2 % each 2.5000 C 14.02:61.50 Terminal Charge

This is all work that needs to be done promptly and with positive accuracy. The satisfaction derived from the accuracy viewpoint alone makes the Comptometer a good investment for any Live Stock Commission Merchant.

## PROVISION BROKERS

## COMMISSION ACCOUNTS

The Commission Merchant dealing in provisions receives goods on consignment.

**When the Goods are Sold—**

There are charges, such as Freight, Storage, Drainage, Insurance and Commission to be deducted in settlement.

The following is a fair illustration of an

ACCOUNT SALES REGISTER

SALE NO.	SALES DR.	FREIGHT CR.	STORAGE CR.	DRAINAGE CR.	INS. CR.	COM. CR.	REMIT CR.
1	37.60	1.00	1.15	.95	.25	1.32	32.93
2	18.70	.96	1.00	.75	.25	.65	15.09
3	100.20	1.25	1.20	1.00	.40	3.51	92.84
4	97.60	1.15	1.10	.95	.35	3.44	90.63
5	76.80	1.00	.75	1.00	.41	2.69	72.85
6	83.75	1.15	1.09	1.15	.55	2.93	76.65
7	75.00	.95	.85	.80	.26	2.63	69.51
8	42.75	.85	.70	1.00	.35	1.50	38.35
9	38.77	.73	1.00	1.25	.37	1.36	34.13

Commission  $3\frac{1}{2}\%$

The Commission must be figured, all of the expenses added and deducted from the amount of the sale, and each item proven.

## METHOD No. 1

Figure the Commission: $\$37.60 \times .035$ .....	\$ 1.32
Add the various expenses.....	4.67
Clear the machine and add in the gross amount of sale .....	37.60
Deduct the expenses.....	4.67
	<u>\$32.93</u>

## METHOD No. 2

With a ten or twelve-column Comptometer figure the Commission on the left of the machine.....	\$ 1.32
Add all expense items on right of machine..	4.67
Deduct the Gross Sales negatively, then depress, twice, the negative keys of amount showing in Register (small 6706 holding back the cut-off at the left). This records the actual difference .....	\$32.93
Leaving this amount in the Register, add each item of expense for proof:	1.32
	.25
	.95
	1.15
This gives the amount of Gross Sale and an absolute proof.	<u>1.00</u>
	<u>\$37.60</u>

---

## PACKING HOUSES

The following constitutes the general items of work in the Packing House Offices on which Comptometers are employed.

In many offices, various items of work will be found in departments other than those specified.

The volume of Comptometer work is great and cannot even be approximated through this list of uses.

### BOOKKEEPING:

- Proving Daily Postings.
- Balancing Ledger Accounts.
- Taking Off Trial Balances.
- Adding Statements.
- Adding Special Records.
- Adding Salesmen's Expense Accounts, etc.
- Figuring interest on notes and anticipations.

### CASHIER AND PURCHASE DEPARTMENTS:

- Adding and Balancing Daily Cash.
- Balancing Remittance Sheets against Checks.
- Adding Deposit Slips.
- Adding Loose Checks.
- Distribution of Cash.
- Proving Extensions and Footings on Purchase Invoices.
- Figuring Interest on Notes and Anticipations.
- Proving Live Stock Scale Tickets.
- Figuring Average Weights.

### TRANSPORTATION:

- Figuring and Proving Freight on Shipments and Receipts.
- Pro-rating Freight Charges, etc.
- Figuring Total Tonnage.
- Figuring Average Rates per Cwt.

### BEEF, TESTING AND STATISTICAL DEPARTMENTS:

- Figuring Percentages.
- Figuring Average Costs.
- Pro-rating.
- Figuring Beef Margins and Actuary Reports.
- Figuring Extensions and Footings on Departmental Transfers.
- Figuring Distribution.
- General Adding and Extensions on all Reports, etc.

### BILLING DEPARTMENT:

- Figuring all Extensions by Pound, Piece, Dozen, Gross, etc., on House Sheets, Invoices, and Account Sales.
- Deducting the Tare.
- Footing Invoices.
- Figuring and Proving Average Prices.
- Proving all Extensions and Footings, accumulating where practicable.

### SALES DEPARTMENT:

- Proving Extensions and Footings on Branch House Reports.
- Totaling and Proving Recap. Sheets.
- Balancing Salesmen's Route Reports, Distribution of Sales per Salesman, Department and Territory.
- Adding Daily Sales for Departments and Branches

### GENERAL:

- Extending and Footing Payrolls.
- Getting Denominations for Payrolls.
- Extending Quantities and Totaling Monthly Inventories.
- Original Figuring and Proving Scale Tickets at the Yards.

---



**PACKING HOUSES—Continued**

Packing Houses require a great many account and report forms in handling their operations. The figuring is voluminous. The Comptometer is correspondingly useful in their Accounting, Pay Roll, General Bookkeeping and Statistical Work. **Comptometer Methods**, as outlined in the following pages, will result in accuracy, efficiency and economy and should soon **save the cost of installation**.

**CONSIGNMENT ACCOUNTS**

Consignment shipments go through about the following routine:

A number of typewritten copies of the goods ordered are written. The original is on an invoice form and will constitute the invoice. The first duplicate will be the House copy of the invoice. Tissue carbons are made for each department that will supply any part of the order. There may be from 2 to 25 tissue copies, according to the variety of goods ordered.

Each department supplying any part of the order itemizes the quantities furnished by that department on the tissue copy and totals same. The tissue copy is then returned to the office.

**EXAMPLE:**

Dept. "H", 8—50lb. Boxes No. 36—	52¼
	53½
	50
	55
	54
	52¾
	49
	53
	<hr/>
	419½

**CONSIGNMENT ACCOUNTS—Continued**

The first duplicate goes to the Shipping Room, where the weights and quantities actually shipped are entered and this duplicate is then returned to the Invoice Department.

The unit prices are filled in on the invoice and duplicate by two different clerks, to minimize errors in pricing.

**COMPTOMETER WORK—INVOICE DEPARTMENT**

One Bill Clerk—

Re-adds the quantities on the tissue copies;  
Enters the totals on the original invoice;  
Extends the items;  
Adds the extensions for invoice total.

Another Bill Clerk—

Extends and totals the duplicate.

The totals are then compared. If they agree, the invoice is mailed directly; otherwise, all items, extensions and totals are proven on the Comptometer.

**CONSIGNMENT INVOICE**

WM. ANDERSON & COMPANY				
In % with U. S. PACKING COMPANY				
Quantities	Description	Unit Quantities	Price	Amount
3½ gro.	No. 37 Soap	42 dozen	32c	\$ 13.44
3 cases	No 51 "	3 "	3.60	10.80
465#	Oil 465 Tare 63#	53.6	42c gal.	22.51
*3245#	"	9.271	15.00 tce	139.07
	Beef	865#	12.50	108.12
	"	234#	9.75	22.82
	Mutton	462#	7.65	35.34
8-50#	Pork Loins	419½	16½c	69.22
			Total	\$421.32

\*350# to a tierce

### CONSIGNMENT ACCOUNTS—Continued

Figure the original extensions separately and then add for the total.

**To Prove**, extend accumulatively, arriving at the Grand Total and thus proving the extensions and additions in the one operation.

#### INVOICING

EXAMPLE:

JOHN SMITH				
To U. S. PACKING CO., DR.				
Date	Weight	Description	Price	Amount
1/7	1465	35	.081 $\frac{1}{4}$	\$120.86
	853	47	.103 $\frac{3}{4}$	91.70
	2740	26	.061 $\frac{1}{2}$	178.10
	30 doz.	Eggs	.241 $\frac{1}{2}$	7.35
	381 $\frac{1}{4}$	Butter	.36	13.77
	2	B. Bacon		
		16# @	.23	3.68
				<u>\$415.46</u>

#### DETERMINING THE AVERAGE PRICES

A great deal of the Packing House billing requires the finding of the average prices per lb., which is merely dividing the total weight into the total amount.

EXAMPLE:

In the above invoice, the net weight of meat is 5058 lbs.

It is invoiced at \$390.66.

The average price per pound is—

$$390.66 \div 5058 = .07723 \text{ lb.}$$

#### FIGURING THE RED TEST

In this work the average price per lb. is the final result required.

Weight	Price	Amount	Average
6742	10.15		
17263	11.25		
32440	9.77		
8472	11.25		
<u>64917</u>		6748.89	10.40

Therefore, first total the weight, then accumulate the extensions, getting the total amount for the entire quantity (as we do not care for individual extensions here). Divide by the total weight, and the result is the average price.

## PRODUCE ACCOUNTING

### ACCOUNT SALES OF POULTRY

WILLIAM ANDERSON & Co. IN a/c WITH U. S. PACKING CO., U. S. A.					
	Gross Weight	Tare	Net	Price	
7 Hens	157	126	31	11½c	\$ 3.57
30 Springs	241	157	84	12	10.08
2 Roosters	<u>126</u>	<u>113</u>	<u>13</u>	6	<u>.78</u>
	524	396	128		\$14.43
8 Eggs		30 doz.	240	18	43.20
8 Crates only				20c	\$ 1.60
					<u>\$59.23</u>

### COMPTOMETER METHOD

By the consignee in making up the Account Sales

Add the Gross Weight in the machine . . . 157  
 Subtract out the Tare . . . 126

31

Extend the net quantity by the price . . . 11½

\$3.57

Complete each extension as above.

Add each column of Gross Weights, Tares and Nets.

Add the Tare and Net to prove against the Gross.

**Prove the Extensions and Additions.**

Accumulate the quantities by prices over Fixed Decimal.

### THE PACKING HOUSE METHOD OF PROVING

Add each Net Weight to the Tare, equals the Gross.

Extend the Net Weights by prices over a Fixed Decimal, accumulating to the total.



---

### INVOICE OF COMMISSION GOODS

Illustrated on opposite page is a sample Invoice of Commission Goods.

There may be several quantities at different prices that belong to the same lot. These quantities must be extended by their respective prices.

Then the average price for the lot must be determined.

Totals must be made.

Freight must be figured and deducted.

The steps in figuring this invoice would be as follows:

- 1st: Extend the Weights by the Dressed Cost;
  - 2nd: Add the Amounts and Weights for each lot;
  - 3rd: Divide the Amount for the Lot by the Total Weight to get the Average Cost;
  - 4th: Add the Total Amounts and the Total Weights;
  - 5th: Divide the Total Amount by the Weight for Total Average;
  - 6th: Extend the Freight on each class and add to the amount. (The several classes of meats take different freight rates.)
  - 7th: Add the several Totals for Grand Total and add the several Freight Items for the Total Freight.
  - 8th: Add the Total Amount of Goods and Total Freight for the Grand Total.
- The amounts shown in "rings" represent the General Average Price.
-

### BRANCH HOUSE SALES INVOICE

The Branch Houses usually make their invoices in triplicate —

- One copy going to the Customer,
- One copy being retained by the Branch Office,
- One copy going to the Home Office.

They also make a Daily Recap. of Sales, which is forwarded to the Home Office, together with the invoices each day.

BRANCH HOUSE INVOICE				
JOHN SMITH		No. 76		
		TO		
		U. S. PACKING CO., SEATTLE		
Quant.	Desc.	Wt.	Price	Am't
4	36 Beef	127#	10 $\frac{3}{4}$	\$13.65
2	32 "	60#	8 $\frac{1}{2}$	5.10
1	50 "	245#	12 $\frac{1}{4}$	30.01
3	25 Shd.	40#	19	7.60
				<u>\$56.36</u>

The first operation at the Home Office is to prove these Branch House invoices.

Make the extensions over the Fixed Decimal and accumulate to the total. This proves both the extensions and additions in the one operation.

The second operation is to add the amounts of the various invoices of the day for the total and enter this on the Home Office Recap. of the Branch Daily Sales. Then compare this amount with the total of the Daily Recap. of Sales.

HOME OFFICE MONTHLY RECAP.		
Branch Daily Sales		
Branch No. 1		SEATTLE
DATE	AMOUNT	AMOUNT
12-1	218.59	✓
2		
3		
4		
5		

If the amounts agree, it eliminates adding the Daily Recap.

DAILY RECAP OF SALES	
Branch No. 1	
Date 12-1-12	SEATTLE
NAME	AMOUNT
John Smith	56.36
Wm James	72.56
W.B. Hyndall	34.78
Geo Jefferson	16.25
Hermann Fleckner	38.64
	<u>218.59</u>

## THE CAR ROUTE

This is a record of a car or trainload shipment, which will be distributed at various cities along the route.

There is a great deal of adding of the numerous items into class totals. The Comptometer has been found a money-saver on this class of work.

## METHOD

Add the "Soap Quantities" and jot down the answer..... 22285

Leave this in the register and add to it the cattle, calves, sheep, butterine, etc., for the **Total Commission goods.**

..... 219898

Clear the machine and add the Beef Sales of F. O. B. Goods.

Ans..... 97246

Clear and add Pork Sales of F. O. B. Goods.

Ans..... 153943

Clear and add S. P. & D. S. Pork. F. O. B. Goods. Ans..... 6703

## CAR ROUTE STATEMENT

Salesman		Route	
Plant		Week Ending	
No.	Product	Weight	Am't. Sale
COMMISSION GOODS			
230	Cattle (Incl. Qtrs.)	12,042 1/2	542 83
171 1/2	Calves	2,556 1/2	116 12
442 1/2	Sheep	16,119	73 81
			731 16
	Laundry Soap	76 80	28 08
	White Laundry Soap	18 74	2 85
	Pride Cleanser	3 43	1 05
	Soap Powder	4 10	16 51
	Wool Soap	11 05	9 91
	Toilet Soap	66 52	71 92
			34 32
			100 73
			81 84
			1 81
			384 38
			50 01
	Meat Cuts, regular	502 73	421 40
	Beef Cuts, Boneless	96 50	66 14
	Frozen Beef Cuts	452	2 33
	Mutton and Veal Cuts	62 82	41 94
	Fancy Meats	139 10	144 86
	Hotel Sales	152 19	170 57
		972 41	847 84
	Hogs	45 50	64 16
	Pork Cuts, Fresh	1483 43	1418 92
	Frozen Pork Cuts	50	
	Total Fresh Pork	1538 43	1483 13
	S. P. Pork	20 16	22 63
	D. S. Pork	36 87	23 30
		6703	46 93
	Wizard Hams	115 49	144 20
	Wizard Bacon	64 33	135 91
	Other Smoked S. P. Meats	470 82	514 24
	Smoked D. S. Meats	27 39	69 07
	Chpd. and Skd. D. Beef	5 33	15 81
	Other Dried Beef	24 05	25 42
	Total Smoked Meats	761 41	904 72
	F. O. B. SUB TOTAL	3540 33	3281 67
	Wizard Lard	34 79	22 72
	S. L. and O. F. Lard	366 62	205 89
	Compound and Cokesuet	351 85	153 23
	Cooking	118 99	41 77

## STATEMENT

## METHOD—Continued

Clear and add the "Smoked" F. O. B. Goods. Ans..... 76141

Leave this in the register and add the other F. O. B. sub-totals.

..... 334033  
etc., for quantities.

Add all items in detail for Grand Total of all "F. O. B. Goods" and prove against the footing of Sub-Totals. Continue in this manner for each classification.

Then add each individual group of "Profit and Loss" and Total entire statement.

## KILLING REPORT AND COST FIGURING

### **KILLING REPORT AND MUTTON COST FIGURING**

NO. OF HEAD	LOT	NO.	BOUGHT OF	LIVE WEIGHT	AVERAGE LIVE WT.	LIVE PRICE	LIVE WT. COST	EXPENSES HANDLING	TOTAL LIVE COST	PELTS AMOUNT	FAT AMOUNT	AV. WT.	PLUCKS NO.	PLUCKS AMT.	TOTAL CREDIT	DRESSED VALUE	DRESSED WEIGHT	PER CENT YIELD
78	17	463	Jones	9910	127	6.15	609.47	11.50	620.97	162.75	30.75	64	78	3.15	196.65	424.22	5420	54.7%
100	13		Smith	13410	134	6.40	858.40	17.00	875.40	201.15	5	38.63	100	3.37	242.15	628.09	6880	51.3%

The Killing Sheet at first contains the weight and number of head.  
 In a general way, this is indicative of the work found in the Cost and Test Departments.

**RESULTS THE COMPTOMETER PRODUCES** **EXAMPLE**

1st: **Averages Live Weight**—  
 Divides here the weight by the number of head.  $9910 \div 78 = 127$  lbs.

2nd: **Extends the "Live Amount"**—  
 Multiplies the "Live Weight" by the "Live Price."  $9910 \times \$6.15 = \$609.47$

3rd: **Gets the Total Debit**—  
 Adds "Live Amount" to "Expenses Handling."  $\$609.47 + \$11.50 = \$620.97$

4th: **Figures the "Credit Values"** of—  
 Pelts, Fat and Plucks—  
 Multiplying the Weights by the Prices. Figured from other Tickets

5th: **Gets the Total Credits**—  
 Adds the value of Pelts, Fat and Plucks.  $\$162.75 + \$30.75 + \$3.15 = \$196.65$

6th: **Finds the "Dressed Value"**—  
 Deducts the Total Credits from the Total Debits.  $\$620.97 - \$196.65 = \$424.32$

7th: **Figures the Per Cent of Yield**—  
 Divides the "Dressed" or "Warm Weight" by the "Live Weight."  $5420 \div 9910 = 54.7\%$

8th: **Figures the "Dressed Pound Cost"**—  
 Divides the "Dressed" or "Warm Weight" into the "Dressed Value."  $\$424.32 \div 5420 = \$7.83$

The Comptometer has served to perform all four mathematical calculations in making up this report and Cost Sheet.  
 With some little continued use it soon develops the efficiency on this desk.



## EXPORT BILLING—ITALY

U. S. PACKING COMPANY U. S. YARDS		
Chicago, 3/17/09		
Angelo Parodi Fw Bartholomeo		
SHIPPED TO ORDER U. S. PACKING COMPANY, Genoa, Italy.		
	Quantity	At          Francs
50/500 lb. Fat Backs per 100 Kilos CIF Genoa	Scale Wt. 25255	108 Fr. = 12364.84
Less Ocean Frt.		
31316 lbs. at .1969 Cwt. =	\$61.66 U. S. Currency	323.72
		12041.12
Freight is converted at $5\frac{1}{4}$ Francs = \$1.00	U. S. Value	\$2315.60
Insurance .193 plus 10%		
American value 5.2 Fr. = \$1.00	Insurance	2630.00
$45\frac{1}{3}$ Kilos = 100 lbs.		

## METHOD

First determine the number of Kilos.....	$25255 \times 45\frac{1}{3} = 11448.93$ Kilos
Find the value at 108 Francs per 100 Kilos.....	$11448.93 \times 108 = 12364.84$ Kilos
Figure Ocean Freight at U. S. Currency.....	$31316 @ .1969 \text{ per Cwt.} = 6166$
Convert Freight at $5\frac{1}{4}$ Francs per Dollar.....	$61.66 \times 5\frac{1}{4} = 323.72$ Francs
Subtract and determine the Difference.....	$12364.84 - 323.72 = 12041.12$ Francs
Find the American value .....	$12041.14 \div 5.2 = \$2315.60$
Find the Insurance at .193 .....	$12364.84 \times .193 = 2386.41$
	Plus 10%          238.64
	<u>2625.05</u>

**EXPORT BILLING—HOLLAND**  
**PACKING HOUSES**

<b>U. S. PACKING CO.</b> <b>U. S. YARDS</b>  <b>Chicago, 3/27/09.</b>  <b>U. S. PACKING COMPANY</b> <b>SHIP TO ORDER U. S. PACKING COMPANY, Rotterdam, Holland.</b>		
	Quantity	At
Per 220½ lbs. C. I. F. Rotterdam		
150 tcs. Oilesoil	57076	56 Florins = 14495.49
American value of a Florin = 40c	U. S. Currency	5798.20
	Insurance	6380.00

**METHOD**

Multiply the quantity in pounds by the price per unit and divide by the pounds per unit.....	$\frac{57076 \times 56}{220\frac{1}{2}} = 14495.49$
Convert the Florins into U. S. Currency.....	$14495.49 \times .40 = \$5798.20$
Insurance on American Value plus 10% .....	$10\% \quad \underline{579.82}$
	<b>\$6378.02</b>
Insurance taken on \$6380.00	

## EXPORT BILLING—GERMANY

<p style="text-align: center;">U. S. PACKING CO. U. S. YARDS</p> <p style="text-align: right;">Chicago, 1/27/09.</p> <p style="text-align: center;">U. S. PACKING COMPANY</p> <p style="text-align: center;">SHIPPED TO ORDER U. S. PACKING COMPANY, Hamburg, Ger.</p>		
	Quantity	At Marks
Per 100 pieces C. I. F. Rotterdam		
25 packages Beef Burg Casergrs, 10,000 pcs.	10,000	22½ Marks 2250.00
American value of 1 Mark is 23½c	U. S. Currency	\$528.75

## METHOD

10,000 pieces at 22½ Marks per 100 = 2250 Marks.

Convert into U. S. Currency @ 23½c per Mark.....  $2250 \times .23\frac{1}{2} = \$528.75$

## BAKERIES

All Bakeries have the usual work to be found in other producing establishments, such as—

**Bookkeeping,  
Accounting, and  
Cashier's Work.**

Other work includes such problems as determining the quantities of dough required, e. g.—

**EXAMPLE:**

How many pounds of dough required to make 4860 30½ ounce loaves?

### METHOD

Reduce ounces per loaf to pounds and decimals of a pound and multiply by the number of loaves to be made.

$$30\frac{1}{2} \text{ ounces} = 1.90625 \text{ lbs.}$$

$$1.90625 \times 4860 = 9264 \text{ lbs. Dough Required}$$

How many 30½ ounce loaves will 9264 lbs. of dough make?

Reduce the Dough to Ounces and divide by the number of ounces per loaf.

$$9264 \times 16 = 148,224 \div 30.5 = 4860 \text{ loaves.}$$

## WORKING UP PERCENTAGES OF SALES

They want to find what percentage of the goods made is sold.

This would apply to all of the different classes of goods made,—e. g.

A Bakery made 16748 loaves of White Bread  
And Sold.....15632.

What per cent of the goods made up were sold?

The per cent is shown to the third place.

### METHOD

Divide the quantity sold by that produced, using only first four figures of Divisor, as only three figures are required in the answer.

$$15632 \div 1675 = .933\%$$

### PAYROLL

The Drivers' salaries are frequently a specified wage and a commission on the sales over a certain amount.

**EXAMPLE:**

The U. S. Bakery Company pays their Drivers, say, a weekly salary of \$18.00 and commissions of

2% on sales over \$100.00 up to \$200.00

4% " " " 200.00 " " 250.00

7% " " " 250.00.

Jones' sales for the week are \$297.80. What is his salary?

### METHOD

His wages would be figured as follows:

Use the Fixed Decimal.

Add in the Weekly Wage..... \$18.00

Add in 2% of \$100.00..... 2.00

Add in 4% of \$50.00..... 2.00

Multiply 7% of \$47.80..... 3.35

Total Wages Due..... \$25.35

### MATERIAL USED

A Daily Report of Ingredients used is made up from the various stock record slips, as shown on opposite page.

The total quantity of each article is found and figured at its price.

Some items require totaling in pounds and ounces and converting the ounces into pounds. These quantities are employed in checking up against the production.

Jan. 4. 1912.

DEPT. Bread.

	2.17 Wm. Tell	Perf.	W. Dia.	24.004 Foam	FLOUR C. Stich.	Patent	2.09 Clear	Ent. Wh.	2.17 Rye	1.77 Corn.	Bran	Meal
	57.5			77.55			312	17	120	83	9	100
	12.47			38			256		31		.12	2.00
				354			72	.47	36	1.47		
				97			640		187			
				99					4.10			
				2310			13.38					
				1283								
				1341								
				406								
Conf. A	570 Grap.	SUGAR Powd.	C	Snap	Oxalo	Lard	Cook Oil	Yeast	Milk	MILK Sour	Cond	Butter
	165.2			29.56		1.2	148.8	76.6			42.9	
	2.2			75			2.4	5.4			74.4	
	78.6			46		15	78.6	5.1			56.6	
	81			941			39.10	34			210	
	28.2			162			21.14	23.2			4.	
	7			375			69	14			774	
	69			18238			5	414				
	64			437.78				37.5			53.25	
270 Eggs	Crystal	Molas.	01.44 Molas	Honey	Mac. Coc.	Th. Coc.	Figs	Sul. Rais.	Cur	Walnut	Jelly	
50	17.4	2.8	1.2					365				
1.35	455	10.8	1.2									
	25.94	18	3					21.90				
		.43	.04									
Soda	Ammon.	Salt	38 Gelat.	Gluc.	Glyc.	Cr. Tar.	Egg Col.	Ginger	Cur.	Mace.	Cloves	Allsp.
		136										
		13										
		7										
		2										
		37										
		15										
		23										
Orange	Lem. Oil	Van.	Alch	Cocum.	Caraw.	Maple	Tar. Acid	Choc.	V. S.			
		58			12.7							
		3			6							
		13										
		316			.05							

## BUILDING CONTRACTORS

Building Contractors have the usual work of—

**Bookkeeping,  
Cashier's Work, and  
Purchase Invoices,**

to which the Comptometer applies in the most practical manner.

Other work on which it soon becomes indispensable if rightly applied is—

### PAYROLL

Figuring Time Slips,  
" Job Material Slips,  
" Estimates,  
" Lumber Invoices,  
" Job Costs, and  
" General Statistical Work.

### CONTRACT ESTIMATING

This is of such a variety as to require nearly every kind of a calculation. The "Comptometer Short Cuts," through its ability to perform all of the four mathematical calculations without clearing the machine, makes it a wonderful assistant.

By the old method of figuring estimates, it has been necessary to extend each quantity separately. The Contractor may, at first, think he must continue this long method, so that he can easily cut out or add to any quantity or cost, if a change should be made.

The Comptometer is a wonderful assistance in making accurate extensions, and footing and proving to positive results, handling the estimates in the same manner.

But, for the man who is looking for the highest efficiency, the quantities, by classes of material, can easily be accumulated to one total; then, one extension made covering the total cost of that class of material.

The recalculation of any revisions in an estimate is so quickly done and proven with the Comptometer, that, at most, it consumes but a fraction of the time that has been saved by the **Comptometer Accumulation Method**.

### BUILDING CONTRACT

The Estimate on the opposite sheet is figured in single quantity extensions.

① METHOD 1	
Mentally multiply $3 \times 3 \times 2$ .....	= 18
On Comptometer, $93 \times 18$ .....	= 1674
and divide directly by 27, without clearing the machine.....	= 62
Mentally multiply $3 \times 3$ .....	= 9
On Comptometer, $9 \times 18$ .....	= 162
and divide directly by 27.....	= 6
Leave this result in the machine and add to it.....	= 62
Equals.....	68
68 cu. ft. $\times$ \$1.50 per cu. ft. ....	= \$102.00

METHOD 2	
Mentally multiply $3 \times 3 \times 2$ .....	= 18
Comptometer, $93 \times 18$ .....	= 1674
Leave this result in the machine and multiply the next volume directly over it, $9 \times 18$ .....	= 1836
Now, divide by 27.....	= 68 cu. yds.
Leave this in the machine and multiply by \$1.50 per cu. yd. ....	= \$102.00
(Continued on following page.)	

## BUILDING CONTRACT ESTIMATING

ESTIMATE FOR - Am. Exp. Bldg.

JAMES STEWART and CO.

Sheet No 1<sup>a</sup>

	QUAN.	PRICE	EXTEN.	TOTALS
<b>BRICK CROSS WALLS-BRICK LONGIT WALL and FIRE DOORS.</b>				
EXCAV. - 2 Vol. $93^2 \times 3^2 \times 3^2$ ①	62			
1 - $18^2$ - - -	6			
	68	Cu. Yd 150		102
<b>CONC. FOOTINGS</b>				
2 Vol. $93^2 \times 3^2 \times 1^2$	558			
1 - $18^2$ - - -	54			
2 - $93^2 \times 2^2 \times 2^2$ ②	744			
1 - $18^2 \times$ - -	72			
CLEAN DOWN BRICK WORK	1428	53 Cu. Yd 600		318
BRICK WALLS - 2 Walls $36^2 \times 4^2 \times 1^2$	288			
2 - $94^2 \times 33^2 \times$ -	6204			
1 - $20^2 \times$ - - -	660			
2 - $94^2 \times 3^2 \times 0^2$	376			
1 - $20^2$ - - -	40			
1 - $630^2 \times 7^2 \times 1^2$	4410			
33 Pilast. $8^2 \times 2^2$ -	660			
21 Pr. Sp. $18^2 \times 8^2$ -	3024			
OUTS 2 - $18^2 \times 12^2 \times 1^2$ 432	15662			
4 - $14^2 \times 8^2$ - 448	880			
	14782	311 M Br. 18.25		5676
STEEL LINTELS { 22 - 9" I - 21" - 20" L <sub>4</sub>	9240			
and { 4 - 12" - 20" - 36" -	2952			
TRACK SUP. { 8 - 10" - 15" - 28" -	3360			
{ 11" - - - - 36" -	5940			
+10%	21492	12 Ton 55.50		666
GLAZ. TILE COPG. 8" Wall	2149	220 Lin. Ft. 35		74
FIRE DRS. - 3 Ply Tin Cover.				
4 - 2 Sides - $18^2 \times 13^2$	962			
8 - - - $16^2 \times 8^2$	1066			
22 - 1 - $9^2 \times 8^2$ +25%	1711			
	3733			
3739 x 3	11217			
+25%	14021	4 M. D. L. R. @ 60" M.	840	
TIN FOR ARCH DOORS				
Twice the Area, 3739	7478	30 sq. Tin @ 11	990	1630
+20%	8974			
HARDWARE				
Track		880 Lin. Ft. @ 1	880	
Hangers		62 Ft. @ 4	248	
Fusible Links etc.		17 Open'gs 10	170	
Brackets		138 1	202	
Total For Sheet.				9116

CONTRACTORS BUILDERS  
AND ENGINEERS HAVE  
QUANTITIES OF WORK  
OF THIS NATURE.

(1) (2) (3) BETTER TO ACCUMULATE  
EXCAVATIONS.

(MENTALLY  $3 \times 3 = 9 \times 2$  VOL. = 18)

ACCUMULATE {  $18 \times 93$   
 $18 \times 9 = 1836 \div 27 = 68$  CUB. FT.

FOOTINGS.  
(MENTALLY  $3 \times 1 \times 2$  VOL. = 6)

ACCUMULATE {  $93 \times 6$   
 $18 \times 3$   
 $93 \times 8$   
 $18 \times 4 = 1428$

(4) A GOOD PLAN:-

FIRST DETERMINE THE LINEAL  
FEET FOR EA. SIZE. 440

THEN ACCUMULATE BY THE 144  
CORRESPONDING WEIGHTS. 224

396

## CONTRACT ESTIMATING

②

### METHOD—Continued

This would be figured in the same manner as the foregoing.

③

First, figure the deductions, so that, later, when the gross total cubic feet is in the machine, we can at once subtract out the correct amount.

Mentally	Accumulate on Compt.
$2 \times 12 = 24$	$18 \times 24$
$4 \times 8 = 32$	$14 \times 32$

880

Jot this amount down on Estimate Sheet. Now, accumulate the total cubic feet in the walls.

Mentally	Accumulate on Compt.
$2 \times 4 = 8$	$36 \times 8$
$33 \times 2 = 66$	$94 \times 66$
$2 \times 3 \times \frac{2}{3} = 4$	$94 \times 4$
$3 \times \frac{2}{3} = 2$	$20 \times 2$
.....	$33 \times 20$
.....	$630 \times 7$
$8 \times 2\frac{1}{2} = 20$	$33 \times 20$
$21 \times 8 = 168$	$168 \times 18$

Total cubic feet..... 15,662

(In the one continuous operation)

Leaving this in the machine, subtract the  
outs..... 880

14,782

Multiply this directly by 21

Brick per cu. ft..... = 310,422, as 311 M.

311 M. @ \$18.25..... = \$5,676

Clear the machine and make each

multiplication independently,

or, with the accumulated cubic

feet in the machine..... 14,782

Multiply by 21 Brick per cu. ft. = 310,422 Brick

Considering the number of odd

brick as 1000, merely add 1000 = 311-442

Disregard the 442.

Take Key Position on 311 over it-

self and multiply by the price,

\$18.25. Multiply only four times

in the first position, as the

Multiplier, 311, is already in the

machine once, of course, moving

toward the left..... = \$5,675.75

or as..... 5,676.00

Complete the extensions in this order. Then add the items for the total.



## RADIATION FIGURED ON THE COMPTOMETER

Architects, Heating Engineers, Contractors, Builders, Steam and Hot Water Fitters, etc., figure radiation required for heating rooms and buildings.

Considerable Adding and Calculating is involved. The Comptometer lightens the work and economizes on time and brain energy.

In figuring radiation, allowances must be made for the loss of heat through the walls, floors, etc., and for the fresh air required to ventilate.

### GENERAL FORMULA

Determine first:—Cubic contents of room,  
Square feet of glass surface,

Square feet of exposed wall, (less glass surface),

Then multiply these results by the constants for temperature desired, found in the following tables and divide that result by the constant for temperature desired in either steam or hot water heat.

TABLES SHOWING LOSS OF HEAT PER SQUARE FOOT FOR VARYING DEGREES OF TEMPERATURES							
Temperatures .....	1	40	50	60	70	80	
Cubic Contents Air .....	..	.822	1.028	1.234	1.439	1.64	
<b>Glass Surfaces</b>							
Single Window .....	1.20	48.00	60.00	72.00	84.00	96.00	
Single Skylight .....	1.50	60.00	75.00	90.00	105.00	120.0	
Single Monitor .....	1.35	54.00	67.50	81.0	94.50	108.0	
Double Window .....	.56	22.40	28.00	33.60	39.20	44.8	
Double Skylight .....	.62	24.80	31.00	37.20	43.40	49.6	
Wood Door .....	.42	16.80	21.00	25.20	29.40	33.6	
<b>Exposed Walls Ordinary Brick</b>	Thick						
	4	.68	27.2	34.	40.8	47.6	54.4
	8	.46	18.4	23.	27.6	32.2	36.8
	12	.33	13.2	16.5	19.8	23.1	26.4
	16	.27	10.8	13.5	16.2	18.9	21.6
	20	.23	9.2	11.5	13.8	16.1	18.4
	24	.20	8.0	10.0	12.0	14.0	16.0
	28	.18	7.2	9.0	10.8	12.6	14.4
	32	.16	6.4	8.0	9.6	11.2	12.8
	36	.15	6.0	7.5	9.0	10.5	12.0
	40	.13	5.2	6.5	7.8	9.1	10.4
<b>Exposed Ordinary Furred Brick Walls</b>	4	.28	11.2	14.0	16.8	19.6	22.4
	8	.23	9.2	11.5	13.8	16.1	18.4
	12	.21	8.4	10.5	12.6	14.7	16.8
	16	.19	7.6	9.5	11.4	13.3	15.2
	20	.16	6.4	8.0	9.6	11.2	12.8
	24	.14	5.6	7.0	8.4	9.8	11.2
	28	.13	5.2	6.5	7.8	9.1	10.4
	32	.12	4.8	6.0	7.2	8.4	9.6
<b>Corrugated Iron on Thick Wood or Steel Bracing</b>		.84	33.6	42.0	50.4	58.8	67.2
<b>Cement Plaster on Wire Lath</b>	Thick						
	1'6" to 2'6"	.615	24.6	30.75	36.9	43.05	49.2
	2'6" to 3'6"	.492	19.68	24.6	29.52	34.44	39.36

TABLES SHOWING LOSS OF HEAT PER SQUARE FOOT—Continued

Temperatures .....	Thick	1	40	50	60	70	80
Overlapping Clapboards .....	$\frac{1}{8}$ "	.44	17.6	22.0	26.4	30.8	35.2
Overlapping Clapboards and Paper .....		.31	12.4	15.5	18.6	21.7	24.8
Overlapping Clapboards, Paper and Sheathing .....		.28	11.2	14.0	16.8	19.6	22.4
Overlapping Clapboards, and $\frac{1}{8}$ -inch Sheathing .....		.23	9.2	11.5	13.8	16.1	18.4

The foregoing constants are for outside walls and are to be considered as having lath and plaster inside, and outside covering as described.

Add 10 per cent for north or windy exposure.

Add 10 per cent if heated day time only.

Add 30 per cent if heated day time only and greatly exposed.

Add 50 per cent if heated only at long intervals.

These percents will vary according to climatic conditions.

Temperatures .....	1	40	50	60	70	80
Inside Partitions, Ord. Stud., Lath and Plaster, One Side .....	.60	24.0	30.0	36.0	42.0	48.0
Inside Partitions, Ord. Stud., Lath and Plaster, Both Sides .....	.34	13.60	17.0	20.4	23.8	27.2
<b>Floor Surfaces</b>						
Cement or Tile .....	.31	12.3	15.4	18.5	21.6	24.7
Dirt .....	.23	9.2	11.5	13.8	16.1	18.4
Ordinary Wood on Ground .....	.10	4.0	5.0	6.0	7.0	8.0
Wood on Cement .....	.08	3.2	4.0	4.8	5.6	6.4
Wood, single $\frac{1}{8}$ -inch, no plaster under joists .....	.45	18.0	22.5	27.0	31.5	36.0
Wood, single $\frac{1}{8}$ -inch, lath and plaster under joists .....	.26	10.4	13.0	15.6	18.2	20.8
Double Wood, no plaster .....	.31	12.4	15.5	18.6	21.7	24.8
Double Wood, lath and plaster .....	.18	7.2	9.0	10.8	12.6	14.4
<b>Roof Surfaces</b>						
Slate, exposed .....	.80	32.0	40.0	48.0	56.0	64.0
Slate, over Wood .....	.30	12.0	15.0	18.0	21.0	24.0
Iron, exposed .....	1.32	52.8	66.0	79.2	92.4	105.6
Iron, over Wood .....	.17	6.8	8.5	10.2	11.9	13.6
Composition, over Wood .....	.30	12.0	15.0	18.0	21.0	24.0
Tiling $\frac{1}{4}$ -inch to 1-inch thick .....	.80	32.0	40.0	48.0	56.0	64.0
6-inch Hollow Tile, 2-inch Concrete, Tar and Gravel Rubble .....	.36	14.4	18.0	21.6	25.2	28.8
8-inch Hollow 1-inch Concrete Tar, Gravel or Rubble .....	.40	16.0	20.0	24.0	28.0	32.0
4-inch Concrete, Cinder Fill .....	.60	24.0	30.0	36.0	42.0	48.0
6-inch Concrete, Cinder Fill .....	.54	21.6	27.0	32.4	37.8	43.2

## FIGURING RADIATION

## Constants for Various Temperatures of Steam or Hot Water Heat

Steam	Water
40 Deg.— 290	50 Deg.— 180
50 Deg.— 265	60 Deg.— 170
60 Deg.— 260	70 Deg.— 150
70 Deg.— 240	

## EXAMPLE:

How many sq. ft. of radiation is required to heat the following room?

Heat — Hot water.

Temperature — 60 degrees with outside at zero.

Room —  $45 \times 128 \times 15$ .

Walls — Cement plaster on wire lath 2' 6" to 3' 6" thick.

Windows — 14 —  $8 \times 16$ .

Exposure — On all sides.

## COMPTOMETER METHOD

## Find the Cubic Contents.

Multiply the length by the width, by the height, Three Factor Method,

$$45 \times 128 \times 15 = 86,400 \text{ cu. ft.}$$

## Find the Sq. Ft. of Glass Surface.

Multiply the height by the width by the number of windows.

$$16 \times 8 \times 14 = 1,792 \text{ sq. ft. glass.}$$

## Find the Sq. Ft. of Exposed Wall.

Double the height and multiply by the width and length.

$$30 \times 45 \times 128 \dots\dots = 5,190 \text{ sq. ft.}$$

Deduct the Sq. ft. of glass.... 1,792

$$= 3,398 \text{ Net Sq. ft. of exp. wall.}$$

Now look on the tables for the constants.

Under Cubic Contents — Below the Temp. 60 Deg. is constant, 1.234.

Under Glass Surface — Below the Temp. 60 Deg. is constant, 72.

Under Exposed Walls, Cement Plaster on wire, lath 2' 6" to 3' 6" thick, constant, 29.52.

Hold respectively the constants over Fixed Decimal for Key Factors and multiply the cubic contents, glass surface and exposed wall, accumulating to the Total,

$$\text{Cu. Ft.} \dots\dots\dots 86400 \times 1.234$$

$$\text{Sq. Ft. Glass} \dots\dots\dots 1792 \times 72.$$

$$\text{Sq. Ft. Exp. Wall} \dots\dots\dots 3398 \times 29.52 \text{-----}$$

$$335950.5$$

Split the larger multipliers, as 29.52, first multiplying through by 29, then by 52.

Leaving the accumulation in the Comptometer, divide it by the constant for 60 degrees in Water heat, 170 = 1976 Sq. Ft., Radiation required to heat the room.

---

## MINING

The Mining and Smelting business involves large quantities which require many long Extensions and Divisions. The 10 or 12 column Comptometer should always be used for this work.

### SOME USES

#### Payrolls.

- Adding time.
- Adding quantities.
- Extending time by days, hours, months.
- Baskets, Barrels, Wagons, fathoms, etc.
- Prorating pay on contract basis.
- Figuring and deducting charges, etc.

#### Bookkeeping Work in General.

See "Bookkeeping."

#### Other Reports, etc.

- Daily Man Report.
- Mining Captain's Reports.
- Rock & Mineral Reports.
- Statements of Results.
- Hoisting Record.
- Daily Concentrating Reports.
- Supply Sheets.
- Invoicing.
- Sales Records.
- Payrolls.
- Monthly Statements.

and many other forms requiring working up of data.

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**SUPPLY SHEETS**

Each item supplied the mines is entered daily, opposite the name of article.

**METHOD**

Place the Comptometer right beside the Supply Sheet.

Cross-add the items of feet of 1" Hardwood, 42-16, etc., = 278 ft. Enter the total in quantity column. Clear and Re-add for absolute proof.

Leave this in the Register and multiply by the price (3 Factor Way) = \$3.892. Jot down the answer.

Leave this result in the Register and prove by multiplying  $278 \times 14.00$  negatively (see 'Negative Multiplication').

Cross-add quantities of all other supply items and extend and prove in the same manner.

Then add the "Total Cost" columns.

Or

**METHOD 2**

Cross-add and prove the total quantities = 278, etc.

Clear the machine and extend quantity by the price,  $278 \times 14.00 = 3.89$ .

Clear and prove in the same manner.

Note how simple and easy to perform the various mathematical calculations. The efficiency with the Comptometer through performing different mathematical calculations consecutively in any sequence, can be realized only after a thorough and consistent use.

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## PAYROLL IN UNION AND NON-UNION MINES

### GANG WORK ON NET TON BASIS

Say two men working together get a net price of  $11\frac{1}{2}c$  per net ton for coal mined. They share equally.

They mine March 1	59,200 lbs.
2	61,300 lbs.
3	107,000 lbs.
4	53,500 lbs.

Total	281,000 lbs.
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#### METHOD 1

Add the quantities, Touch Method; the hundreds first on the three right columns; then the thousands in the next three columns = 281,000 lbs.

With the "pounds mined," 281,000, in the register, reduce it to tons by dividing by 2; or better, multiply by its reciprocal, .5 (Three Factor Way) = 140.5 Tons.

Now multiply by **one-half of the rate** (3 Factor Way), .0575, equals \$8.08, the wages for each man.

#### METHOD 2

Establish the **rate per thousand pounds per man**; i. e., One-half of Ton Rate  $11\frac{1}{2}c$ , equals **Ton Rate per man**, .0575, and one-half of this equals .02875, the **rate per 1000 lbs. per man**. Hence, multiply directly the weight, 281,000 lbs. by the rate per 1000 lbs.

Hold the rate for Key Factor over the Fixed Decimal, and multiply the **M lbs.**, 281; split the multiplier and use .028 first multiplying towards the left, then shift to the 75 keys and multiply back towards the right, = \$8.08.

#### NON-UNION MINES—Where price is per gross ton

If a uniform number of men are in a shift, divide the rate per man by 2240 and thus establish the rate per thousand, in the above case, .025669; then multiply pounds by weight direct.

Make up a card of these 1000 lb. rates to correspond with the regular rates and multiply over the Fixed Decimal.



### PAYROLL—COKE COMPANIES

Many Coke Companies pay mine laborers on the basis of the number of wagons mined. The usual production is from 20 to 70 wagons per miner for each two weeks' payroll. Each man is likely to have extra Credits for work done on timbering the shafts, digging out slate or water pockets, etc. The price for this special work is largely fixed at the time by the mine boss.

Each time ticket may contain debits for store checks, rent, tool sharpening, lamps and oil, which have to be deducted from the total earnings.

EXAMPLE:

#### PAY ROLL OF GILMORE COKE COMPANY FOR HALF MONTH ENDING NOV. 15, 1909.

No.	Name	Wagon	Rate	Days	Rate	Misc.	Rent	Smithing	Amount Due
1	Mike Mier	62	48	3 1/2	2 50	6 75		25	31 51
2	Joe Fabian	57	48	1 1/2	1 75	10 48		35	19 16
3	Chas. Frank	13	55	1/2	1 75	6 35		55	1 13
		268	48	10 1/2	1 75	69.40	3.50	1.44	135 87
		24.55		6 1/2	2.75				
12									
13	Geo Kaminski	23 20	55 48	2	2 50	5 36		40	21 49
14	Jas. Romanko	20	55	1	1 75	7 16		10	5 49
15	Wm John	33 33	48 55	2	2 75	10 00		50	28 99
16		440	48	5 1/2	2 50	115 50	3 50	3 59	243 64
17		173	55	13	1 75				
18		<del>\$50 635</del>		8 1/2	2 75			<del>\$122 59</del>	
19					<del>\$59 88</del>				
20									



---

**COKE PAYROLL—Continued****METHOD****Extending Individual Wages:**

Hold the Rate, .48, as Key Factor over the Fixed Decimal and multiply the number of wagons, 62.

Leave extension in Comptometer and multiply the number of days, 3.5, by rate per day, \$2.50, holding rate as Key Factor, equals Gross Wage, \$38.51.

Leave 38.51 in the Comptometer and subtract the charges, \$6.75 and .25, equals \$31.51, Amount Due.

Extend each wage in the same manner.

Add all merchandise items, \$6.75, \$10.48, etc., = \$115.50; add the rent items, = \$3.50, the smithing, = \$3.59, and amounts due, = \$243.64.

**To Prove:**

Add the Merchandise, Rent and Smithing Totals = \$122.59.

Add the number of wagons at each rate.

440 wagons @ 48c

173 wagons @ 55c

Then accumulate over the Fixed Decimal by respective rates, equals \$306.35.

Add the number of days at each rate and accumulate by respective rates;

i. e.,  $5\frac{1}{2}$  days  $\times$  \$2.50

13 days  $\times$  1.75

$8\frac{1}{2}$  days  $\times$  2.75

Equals, \$59.88

Leave the Total of Day Wage, \$59.88, in the register and add to it the Wagon Total, \$306.35 = \$366.23,  
Gross Payroll.

Now subtract the "Total Charges," \$122.59 = \$243.64, the net amount due, thus proving all extensions and additions on the Payroll Sheet.

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## MINING CONTRACT

A Party of **Contract Miners** may consist of four or more men. They will usually work in **Day and Night Shifts**. A contract is made with the Mining Company at a stipulated price per fathom, and specified prices which the miners agree to pay the Company for supplies.

## Terms of a Contract

Price per fathom, \$11.50 up to 8 ft. in width of slope; for each additional foot in width, \$10.65.

The opposite form illustrates the reverse side of a Miners' Contract. The net results are figured and entered on the contract form.

The ground broken under this contract was:

62½ feet in length  
19 feet in height  
9½ feet in width

For Comptometer method of working up the results, see following page.

Results of Contract and Division of Proceeds.									
Ground broken under contract 62½ ft. long, 19 ft. high and 9½ ft. wide.									
Shaft Sinking ..... feet at \$..... per ft.									
Dish Sinking ..... fathoms at \$..... per fm									
Driving ..... feet at \$..... per ft									
Sloping ..... $\frac{43.981}{8.247}$ fathoms at \$ $\frac{11.50}{10.65}$ per fm. <span style="float: right;">505 78 87 83</span>									
Total..... <span style="float: right;">593 61</span>									
Supplies used \$ 195 45 Steel Shoring \$..... <span style="float: right;">195 45</span>									
Net proceeds of Contract..... <span style="float: right;">398 16</span>									
Shift No. 1 <span style="float: right;">19 days</span> Shift No. 46									
No.	NAMES	Days	Division of Proceeds		Substitute		Net Amount Due		
			Days	Amount	Days	Amount			
129	Sam Johnson	18	11425	79 84	1	215	77 68		
154	Mike Jolly	18		79 83	6	1290	66 94		
80	Wm. Berger	24		106 44	4	860	97 54		
59	John Pearson	24		106 45			106 45		
								560	25 60
								816 11	23 65 374 51

\* A "Steamer" is merely a substitute furnished by a man who lays off for a day or two. He is paid out of the compensation due the miner for whom he substitutes.

† If added, to balance

## FIGURING CONTRACT WORK—Continued

### COMPTOMETER METHOD

**Determine the number of fathoms.** It is best to use a 10 or 12-column Comptometer. Find the cu. ft.

Multiply the length, 62.5 ft., by the regular contract width, 8 ft., and height, 19 ft., over the Fixed Decimal, equals 9500 cu. ft.

The cu. ft. are now located in the register, where they can be reduced to fathoms and carried out decimally as far as desired.

#### Reduce to fathoms

Leave the cu. ft., 9500, in the register and reduce to fathoms; divide it by 216 = 43.981 fathoms broken @ \$11.50.

Now clear; holding the price, \$11.50, preferably over the fixed decimal, for Key Factor and multiply the fathoms, 43.981 = \$505.78.

If using the 12-column Comptometer, leave the fathoms in the register and multiply three factor way by price.

**Clear and figure the fathoms at lower rate in same manner—**

i. e.,  $62.5 \times 1.5$ , over Fixed Decimal 93.75. Continue three factor way, multiply by height,  $19 = 1781.25$  cu. ft.

Leave in the register and divide by 216 = 8.247 fathoms.

Leave in the register and multiply by the fathom rate, \$10.65, three factor way (if using a 12-column Comptometer), = 87.83.

Leave the result in the register and add to it the amount at \$11.50; i. e.,  $\$505.78 = \$593.61$ .

Still leaving this result in the register, subtract the cost of supplies,  $\$195.45 = \$398.16$ .

Now subtract 16 days' service for water boy @ \$1.60,  $\$25.60 = \$372.56$  net wages for Miners.

**Two miners each worked 24 days, and two worked 18 days each, or a total of 84 days for the four miners.**

**Find the net amount earned per day, leaving the net earnings as above, \$372.56, in the register; divide it by 84 = \$4.4352 per day.**

Clear and extend wages for each miner; hold the days, for key factor, over fixed decimal, and multiply the rate.

$4.4352 \times 18 = \$79.83$ —1 day substitute  $2.15 = \$77.68$

$4.4352 \times 18 = 79.84$ —6 day substitute  $12.90 = 66.94$

$4.4352 \times 24 = 106.44$ —4 day substitute  $8.60 = 97.84$

$4.4352 \times 24 = 106.45$  106.45

Enter results on Contract, and prove and balance.

The number of contracts each month depends upon the size of the mine. Some of the smaller companies have as many as 200 contracts to figure and prove each month. The figuring of these contracts must be completed the first of each month succeeding that in which the work was performed.

The Comptometer saves much time and worry and assures an accuracy otherwise unknown.

### DAILY MAN REPORT

The Time-Keepers report the data as to the "Men Working and Rock Shipped" each morning. When all reports of the men working and tons of rock shipped to mill are received, they are figured and results entered on cards like the one shown below.

#### Compiling Data for "Daily Man Report."

This work requires numerous small additions, which is greatly facilitated by the use of Comptometer. The work of getting the figures together and reporting can easily be reduced to about one-half or one-third of the time otherwise required.

<div> <div>man</div> <div>CONSOLIDATED MINING CO.</div> <div>Daily Report for February 28th, 1910.</div> </div>							
Branch and Shaft	Number of Men Working			Tons of Rock Shipped to Mill	Tons Per Man.		
	Underground	Surface	Total		Under-ground	Sur-face.	U.G. & Surf.
Occ. No. 3	87			120	1.38		
" No. 6	134			240	1.79		
Total	221	63	284	360	1.63	5.71	1.26
S. E. No. 1	212			700	3.30		
" No. 2	99			420	4.24		
Total	311	76	387	1120	3.60	14.73	2.89
N. E. No. 1	223			960	4.30		
" No. 3	205			920	4.49		
" No. 4	85			320	3.76		
Total	513	134	647	2200	4.29	16.41	3.40
TOTAL	1045	273	1318	3680	3.52	13.48	2.79

#### COMPTOMETER METHOD

##### Determine Number of Men Working.

Add the number of men in each mining group,  $87+134=221$ ,  $212+99=311$ , etc. Add the group totals for total of all men working = 1045 and 273.

Cross-add for total of underground and surface men in each mine. Prove the totals against the sum of cross-totals; i. e.,  $1045+273=1318$ ; also the sum of cross-totals.

##### Find the Average Tons per Man.

Divide the "Rock Shipped," 120 tons, by number of men, 87, = 1.38 Tons.

Determine the Average for each mine, both underground and surface and for the "Total" in this manner.

Add for totals of "Rock Shipped."

## MONTHLY HOISTING RECORD

These records are made up at the mine, and forwarded to the General Office.

## METHOD OF WORKING UP DATA FOR THE HOISTING RECORD

Memoranda are made of each skip or car of coal mined, of the weights, the number of trips and hoisting time in minutes. The latter may be divided into several classes, such as for hoisting and lowering men, lowering supplies, water, etc., and again, the time for various delays may be classified.

ARGENTINE CONSOLIDATED MINING CO.																													
SOUTH KEARNS BRANCH SHAFT No. 2.																													
HOISTING RECORD FOR MONTH OF JULY - 1910.																													
HOISTING										DELAYS																			
COOPER ROCK						POOR ROCK				Hoisting and Lowering Men		Lowering Supplies		Hoisting and Lowering Drills		Hoisting Water		Treasurer's Inlays		Casting Skips		Skips at Foot							
Date	Skips	Tons	Time	Skips	Tons	Time	Trips	Time	Trips	Time	Trips	Time	Trips	Time	Trips	Time	Trips	Time	Trips	Time	Trips	Time	Trips	Time					
1	254	552	13 04				6	29	5	97	2	79							190	39			12	210	24				
2	141	306	9 16				14	72											212	35			270	295	24				
3	Sunday																						480	960	24				
4	Holiday																								24				
5	214	464	10 45				7	34	1	30	2	65							361	28			12	265	24				
6	259	562	13 18				15	66	2	13	2	75							166	32				290	24				
5002,0865257 19						186 729 29 517 43 1132						4284 559						3845 9535 600											
Tot. 5870 12749 302						228 930 37 657 49 1351						5213 693						4615 11575 744											
Avg. 234.8 509.9 12 65						9.12 37.2 1.48 26.28 1.96 54.04						208.58 27.78						463 24											
Average time first Man-car down A. M. 7:10										Average time first Skip down A. M. 7:25																			
" " " " " P. M. 6:40										" " " " " P. M. 7:35																			
" " " " " up A. M. 5:00										" " " " " up A. M. 4:50																			
" " " " " P. M. 5:00										" " " " " P. M. 4:50																			
Time Hoisted Per Day 509.9										Average Hours Hoisting Per Day 12:45										Time Hoisted Per Day 2:17									

## DAILY COMPTOMETER WORK

With the original memoranda right beside the Comptometer, the various items of skips, weights, hoisting times, delays, etc., are added for the total of the day; for instance, on the record illustrated the results of first day are 254 skips, 552 tons, 13 hours, 4 minutes time for copper rock, 6 trips hoisting and 29 minutes time lowering men, etc.

## COMPTOMETER WORK

The various items of time on the "Hoisting Record" are mostly entered in minutes and must prove against the total minutes in the day of 24 hours, namely 1440.

Cross-add the items of time for each as follows:

Hold the keys for 60 minutes at the right of Keyboard, and multiply the hours, 13, = 780  
And cross-add the minutes

4  
29  
97  
79  
190  
39  
12  
210

= 1440, the full minutes for the day.

## MONTHLY TOTALS

Add the columns of skips for the month's total,

254, 141, 214, etc. = 5870 skips.

Add each column of tons, trips, and the items of time for each operation.

## THE AVERAGES PER DAY

Divide each total by the number of working days in the month, i. e., for the skips, add 5870 in the Comptometer at the left and divide by 25 = 234.8, average skips per day.

The cipher method of division can be employed to advantage on this class of work if desired. Also the Reciprocal method may be used. The Reciprocal of 25 is .04; so having added the number of skips, and with the total 5870 in the register, multiply it by .04. (3 Factor Way) = 234.8.

Work up each average per day in the same manner.

## ROCK AND MINERAL REPORT—PRELIMINARY COMPTOMETER WORK

The quantities of Tons Stamped, Hoisted, Mined, etc., are added daily for each shaft.

At the end of the month, the daily productions for each shaft are added and entered on the Rock and Mineral Report following:

## ARGENTINE CONSOLIDATED MINING COMPANY

Rock and Mineral Report for the Month of. FEBRUARY - 1910.

BRANCH	SHAFT	Tons Stamped	Tons Hoisted	Tons Mined	TONS DISCARDED			PER CENT OF	
					Rock House	Underground	TOTAL	Hoisted Rock Discarded In Rock House	Mined Rock Dis- carded in Rock House and Underground
Argentine	No. 5	12,717	14,015	16,151	1,398	2,136	3,434		
"	No. 6	18,831 31,548	19,873 33,888	22,447 38,598	1,042 2,340	2,574 4,710	3,616 7,050	6905	18265
Kears	No. 1	22,810	22,935	22,935	125		125		
"	No. 3	24,820	25,005	25,973	185	968	1,153		
"	No. 4	6,173 53,803	6,626 54,566	7,036 55,944	453 763	410 1,378	863 2,141	1398	3827
South Kears	No. 1	21,194	21,326	21,326	132		132		
"	No. 2	13,299 34,493	13,370 34,696	13,370 34,696	71 203		71 203	0585	0585
"	No.								
		119,844	123,150	129,238	3306	6,088	9,394	2685	7269

## MINERAL PRODUCT

BRANCH	Pounds Mineral	Pounds Mass	Total Pounds	Total Tons	Per Cent Mineral in Rock Stamped
Argentine	692,612	16,995	709,607	354 1607	.01 1246
Kears	1,140,623	14,477	1,155,100	577 1100	.01 2735
South Kears	834,730	15,924	850,654	425 0654	.01 2331
Totals	2,667,965	47,396	2,715,361	1,357 1361	.01 1329

# COMPTOMETER WORK ON MONTHLY ROCK AND MINERAL REPORT

(COMPTOMETER RESULTS ARE SHOWN IN PEN AND INK SCRIPT)

Place the R. & M. Report right beside the Comptometer.

Cross-add the Rock House and Underground Discard for each shaft

e. g:—Shaft No. 5—1,298 and 2,136 = 3,434 lb

Add the Tons Stamped, Tons Hoisted, etc., for the Totals of each mine or branch; i. e., for Argentine Branch—

Add Tons Stamped . . . . .	12,717	
	18,831	= 31,548

Kears . . . . .	22,810	
	24,820	
	6,173	= 53,803

Add the several mine totals for Grand Totals and add the Mineral Product Totals —

e. g:—Tons Stamped . . . . .	31,548	
	53,803	
	34,493	= 119,844

## Per Cent of Hoisted Rock Discarded in Rock House for Each Branch and for the Total

Add the Rock House Discard, 2340, in the Comptometer at the left and divide by “Tons Hoisted,” 33,888 = 6.908%

## Per Cent of Mined Rock Discarded

Add the Total Discard, 7050, in the Comptometer at the left and divide by the “Tons Mined,” 38598 = 18.285%

## Per Cent of Mineral in Rock Stamped

Add the Total Pounds “Mineral Product,” 709,607, in the Comptometer at the left and divide by the “Tons Stamped,” reduced to lbs., 63096000 lb = 1.1246 %

The percentage is worked up for each mine and the Total in the same manner.

REPORT TO MINING CAPTAINS ARGENTINE CONSOLIDATED MINING COMPANY.				
February, 1920	ARGENTINE	KEARS	SOUTH KEARS	TOTAL
Rock Mined (Fathoms Broken at 15 tons per Fathom)	40874	60699	31743	133316
Rock Discarded Underground	4710	1378		6088
Rock Hoisted	No.5 14247	No.1 23441	No 1 21368	
" "		No.3 24483	No 2 13328	
" "	No.6 19641	No.4 6642		
" "	33888	54566	34696	123150
Rock Discarded in Rock Houses	2340	763	203	3306
Rock Stamped	31548	53803	34493	119844
Rock Mined in Openings	8966	7262	1020	17248
Rock Mined in Stopes	31908	53437	30723	116068
No. of Drills Working in Op'gs	15½	12½	1½	29½
No. Drills Working in Stopes	34½	49½	35½	119½
No. of Drills, Total	50	62	37	149
Rock Broken Per Drill in Openings.	588	570	583	580
Rock Broken Per Drill in Stopes.	918	1085	872	973
Rock Broken Per Drill, Average	817	979	858	895
Number of Trammers Working	170	182	100	452
Rock Trammed (Hoisted and Discarded Underground)	38598	55944	34696	129238
Rock Trammed Per Trammer	227	307	347	286
Rock Trammed Per Trammer Per Month	9.46	12.79	14.45	11.92
Skips of Rock Hoisted	No 5 3281	No 1 4481	No 1 5409	
" " " "	No 6 3562	No 3 4593	No 2 6203	
" " " "		No 4 1322		
Tons Hoisted per Skip	No 5 4.3	No 1 5.2	No 1 3.9	
" " " "	No 6 5.5	No 3 5.3	No 2 2.1	
" " " "		No 4 5.0		
Total Days Worked	13913	12229	7370	33512
No. of Men Working Underground	580	510	307	1397
Tons Per Man Per Day	2.27	4.40	4.68	3.58
Average Wages of Miners	\$ 71.74	\$ 68.58	\$ 61.58	\$ 67.90
Fathoms Developed During Month by New Openings.	3243	3910	158	7311
Fathoms Stopped During Month (not including Footwall)	1479	2891	1568	5938
% of Mineral in Rock Stamped	.011246	.010735	.012331	.011329

All Comptometer  
Results in Pen  
and Ink Script.



## WORKING UP MINING CAPTAIN'S REPORT

### Report to Mining Captains:

The mining captains' reports are made up at the office and sent to the mining captains each month. They show the average for the month's production and supply each mining captain with the comparative results in the several branches.

The "Rock Mined in Openings and Stopes" is determined by reducing the number of fathoms broken to tons; i. e., by multiplying by 18 fathoms to the ton.

**All Comptometer Results are Shown in Pen and Ink Script.**

All the results shown in bold-face type figures are abstracted from other sources.

### COMPTOMETER WORK

#### Rock Hoisted:

Add the quantities of rock hoisted for each mine on the right of keyboard.

e. g., Rock Hoisted in "Argentine."

14247 Tons

19641 Tons

---

33888 Tons

#### Rock Broken per Drill:

This is determined for "Rock Broken in Openings and Stopes" and the average.

#### The Openings:

Add in the Comptometer at the left the "Tons Mined in Openings," 8966, and divide by the number of drills working, 15.25, = 588 Tons per Drill.

Find the "Tons per Drill in Openings and Stopes" and the average for each mine in the same manner.

#### Rock Trammed per Trammer:

Add the "Rock Trammed," 38598, in the Comptometer at the left and divide by the number of trammers, 170, = 227 Tons per Trammer.

#### Rock per Trammer per Shift:

As there are 227 tons mined per trammer and 24 shifts or days worked in February, add the tons mined, 227, in the Comptometer at the left and divide by the number of shifts, 24 = 9.46 Tons per Trammer, each shift.

#### Tons Hoisted per Skip:

Divide the "Tons Hoisted in each Shaft" by the number of skips,

e. g., Argentine Mine — Shaft No. 5:

Add the tons of rock hoisted, 14247, in the Comptometer at the left and divide by the skips of rock hoisted, 3281, = 4.3 Tons Hoisted per Skip.

#### Tons per Man per Day:

Divide the "Tons Stamped," 31548, by the "Days Worked Underground," 13913, = 2.27 Tons, Average Per Day.

#### Average Wages Per Miner:

This is found by dividing the amount of Miners' Payroll (not shown) by the number of miners working.

## COST PER TON OF ROCK STAMPED

This work requires considerable adding and many divisions. The **Classified Costs** for each mine are abstracted to this form from the cost records. Each item of cost can be divided by the "Tons Stamped" in the corresponding mine.

TONS STAMPED Argentine 31,548 Kears. 55,805 So. Kearns 34,493 TOTAL 119,846	COST PER TON OF ROCK STAMPED							
	ARGENTINE		KEARS.		SOUTH KEARS.		TOTAL	
MINING - Miners' Labor and Supplies.	\$19326.30	.6126	22990.02	.4273	12931.43	.3749	55247.75	.4610
MINING - Other Labor and Supplies.	6798.60	.2155	6025.94	.1120	3877.01	.1124	16701.55	.1394
MINING - Power	1000.07	.0317	2410.37	.0448	1145.17	.0332	4555.61	.0380
MINING - Total	\$27124.97	.8598	31426.33	.5841	17953.61	.5205	76504.91	.6384
TRAMMING - Trimmers' Labor	9644.22	.3057	10104.20	.1878	5384.36	.1561	25132.78	.2097
TIMBERING Labor	3751.06	.1189	274.40	.0051	313.88	.0091	4339.34	.0362
TIMBERING - Supplies	1183.05	.0375	231.35	.0043	382.87	.0111	1797.27	.0150
TIMBERING Total	4934.11	.1564	505.75	.0094	696.75	.0202	6136.61	.0512
HOISTING Power	3085.39	.0978	4368.80	.0812	1869.52	.0542	9323.71	.0778
PUMPING Labor and Supplies	485.84	.0154	145.27	.0027	103.48	.0030	734.59	.0061
PUMPING - Power	463.75	.0147	96.85	.0018	144.87	.0042	705.47	.0059
PUMPING Total	949.59	.0301	242.12	.0045	248.35	.0072	1440.06	.0120
Total Cost per Ton Delivered into Rock Houses.	45738.28	.4449	46647.20	.8670	26152.59	.7582	118538.07	.9891

### COMPTOMETER RESULTS IN PEN AND INK SCRIPT

#### COMPTOMETER METHOD

First add the items of Mining, Timbering, and the Pumping for the separate totals in each mine.

e. g., "Miners' Labor and Supplies," "Other Labor and Supplies," "Power" for "Argentine."

Add \$19,326.30, \$6,798.60 and \$1,000.07 = \$27,124.97.

Continue in the same manner and add the several groups of items for each mine.

Determine "Cost per Ton" for each expense item in each mine.

Add the cost of Miners' Labor and Supplies, \$19,326.30, in the Comptometer at the left and divide by the tons stamped, 31548 = \$.6126, Cost of Miners' Labor and Supplies per Ton Stamped.

Or, better,

As the tons stamped in each mine will be a constant divisor for all items of cost, use the Reciprocal Method; i. e., divide 1 by the tons stamped, 31548, equals the reciprocal, or 31698.

Then holding the reciprocal, 31698, at the left of key-board, multiply each item of cost: (Split the Key Factor, using first 31, then 698).

\$19,326.30, multiplied by 31698 = \$.6126.

\$6,798.60 × 31698 = \$.2155.

Work up results for all mines and shafts in this manner.

## C O A L

### SHIPMENT SHEET

This will contain the records of all shipments, the quantities being recorded in even hundred pounds. Some shipments may be figured on even ton basis, others on either a Gross Ton of 2240 lbs. or a Sand Ton of 2268 lbs.

#### MINE SHIPMENT SHEET

DATE	CONSIGNEE	DESTINATION	CARS		W E I G H T S					TONS	UNIT	PRICE	AMOUNT
			Init'l.	No.	1½ Lump	¾ Lump	M-R	Slack	100-Lbs.				
1912													
3-21	J. A. Jones Co.	Toledo, O.	B. & O.	36784		550				65	N. T.	\$1.05	\$68.25
	"	"	"	35425		719			1300	44.464	G. T.	.75	33.35
3-21	A. B. Smith Co.	Albany, N. Y.	N. Y. C.	76831			1002	996	996	44.732	G. T.	.90	40.26
"	Holly & Co.	Oil City, Pa.	Penn.	13470			892		892	39.33	S. T.	.87	34.22
"	Craig Co.	Beaver, O.	B. & O.	27863									
						1300	1894	996	4190				\$176.08

The Comptometer Operations are:  
 Adding Vertical Columns,  
 Cross-Adding,  
 Converting and Extending Net Tons,  
 " " Gross "  
 " " Sand "

### CONVERTING GROSS AND SAND TONS

#### METHOD 1

Add the Total Weight in the Comptometer and divide by 2240, for the Gross Tons, and—  
 Divide by 2268 for the Sand Tons.

#### METHOD 2

The Gross Ton (2240lbs) Reciprocal is . 000 44643

" Sand " (2268lbs) " " . 000 44092

Use a 10 or 12-Column Comptometer and the Fixed Decimal Method.

Hold the weight for the Multiplier Keys.

Eliminate the three ciphers in the Reciprocal and,

Take the Key Position so that the Thousands figure occupies the column at the right of the Fixed Decimal and multiply by the Reciprocal, moving towards the right:

$$99\ 600 \times .44643 = 44.464 \text{ Gross Tons}$$

$$89\ 200 \times .44092 = 39.33 \text{ Sand "}$$

Leave the Tons in the machine and multiply by the Price, ("Three Factor Work," p. 39).

### FIGURING STATE TAX

Some States charge Mining Companies a Tax on all coal sold. The State requires them to make a separate extension for the Tax.

The Coal Companies are adding the amount of this tax to their sales price of coal. This means a double amount of extensions on the invoicing.

**EXAMPLE:**

Say a State Tax is  $2\frac{1}{2}\%$  of the selling price of coal.

Grate Coal sells @ .....	\$3.03	The tax is .0758
Stove and Egg Coal sells @ .....	3.26	The tax is .0815
Nut Coal sells @ .....	3.48	The tax is .0870
Pea Coal sells @ .....	2.23	The tax is .0558
Buckwheat and Draft Coal sells @	1.34	The tax is .0335

U. S. MINING COMPANY							
SOLD TO							
SAMUELS & SAMUELS							
Via K. & M.				May 16, 1912			
GRADE	CAR NO.	WEIGHT	PRICE	AMOUNT	TAX	AMOUNT	TOTAL
Grate	17865 D&H	53600#	\$3.03	\$ 81.20	.0758	\$2.03	\$ 83.23
Nut	7832 K&M	64300#	3.48	111.88	.087	2.80	114.68
				\$193.08		\$4.83	\$197.91

## WORKING UP CHEMICAL ANALYSIS OF COAL

The Weight of Sample is .9203 lbs.

The Known Factors are:—

Room Temperature 30.0° C.

Setting " 27.2° C.

Water Equivalent 2534 calories per lb. of coal

The Test Shows:

Barium Sulphate .0143 Grammes

Moisture . . . 1.62%

### WANTED:

1st. Sulphur Percent.

A Table shows that .0143 Barium Sulphate equals

1.005 Grammes of Sulphate

1.62% of sample being moisture, the difference, or

.9838% of sample will be the Dry Coal.

$.9838 \times .9203 = .9054$  lbs. Dry Coal.

$1.005 \div .9054 = 1.11\%$  of Sulphur per Gramme.

2nd. The Calories of Heat Generated by the Pure Coal in the Sample.

The increase in the water temperature must be deducted from the maximum temperature and this result corrected to agree with the chart.

Max. Temp.....	3.560	
Increase of Water Temp.	709	
	<u>2.851</u>	This is corrected by
Chart to read.....	2.880	
plus.....	.001	for radiation corrections.
	.007	" setting "
	<u>2.888</u>	

$2.888 \times 2534$  Calories per lb. = 7318.2 Calories of Heat Generated

In this Calorimeter Test, some heat is produced by other elements than coal.

Iron Wire.....	23.4	calories
Acidity.....	10.3	"
Sulphur.....	18.4	"
Total.....	<u>52.1</u>	"

Therefore, the Total

Calories Generated.....	7318.2
Minus for other sources .....	<u>52.1</u>

Equals..... 7266.1 Calories of Heat Generated by Pure Coal Sample.

3rd. How Many British Thermal Heat Units to a Pound of Coal?

One Calory = ..... 1.8 B. T. H. U.  
 Therefore,  $7266.1 \text{ calories} \times 1.8 = 13078.98$  B. T. H. U.  
 in the sample which contained .9054 of a lb. of Dry Coal;  
 therefore, one pound of Coal will produce as many B. T. H. U.  
 as  $13078 \div .9054$ , or..... 14445 B. T. H. U.

## PERCENTAGE OF SIZES

A record of the Tons and cwt. of each grade shipped is furnished by the Mine Superintendent and entered on the following percentage sheet.

SIZES									
BOTH			Sist			Total			
Tons	cwt.	%	Tons	cwt.	%	Tons	cwt.	%	
22714						728	00	0020	
21312	02		7666	15	2591				
17954	05		1708	14	0509	768	16	0445	47681
22711	03		7621	15	2511	524	18	0296	46178
14495	02		1466	16	0483	866	19	0490	49617
76700	06		18744	00	6174	2180	05	1231	200465
19908	12		4871	10	1603	321	14	0182	41514
15024	06		5166	14	1702	889	17	0502	42190
21819	00		711	15	0234	4628	11	2614	46055
10227	05		866	10	0285	9688	15	5271	34229
821	14								5813
									02
144001	03		30360	09	10000	17709	02	10000	370267
									05
									10000

The information wanted is:

Quantity of coal shipped daily that is larger than Pea Size.

Total quantity of all coal shipped daily.

The percentage of each kind of coal shipped to the Total Daily.

The percentage of above Pea Sizes.

The quantity shipped of each grade is given in Tons and cwts.

Thus, the first item is 288 Tons, 18 cwt.

### METHOD WITH COMPTOMETER

Add the quantities of the various grades above Pea coal, for the day, = 27,975.00 Tons.

Then continue and add to the above the several other quantities shipped = total for the day, 51,067 Tons.

First add the cwt. on the right of Keyboard, 18, 7, 11, and 4 = 40.

Convert the cwt. into tons by dividing by 20, or multiply cwt. by the Reciprocal of 20 or .05 = 2 Tons.

Then continuing, add the tons, 288, 8435, etc., directly over the converted amount = 27,975.00 Tons.

Continue in this manner for all daily totals.

### FIGURING THE PERCENTAGES

Find the percentage of each grade of coal shipped.

The Total Tons for the day must be divided into each of the several quantities shipped.

As the total quantity shipped, 51067, is used as a constant divisor for several quantities, use the Reciprocal Method.

See "Reciprocal Method," for pointing off.

Divide 51067 into 1, carrying Reciprocal to the 5th figure = 19582.

Hold the Reciprocal, 19582, at left of Keyboard for Key Factor and multiply each quantity

Split the Key Factor and first multiply through by 19, then shift to the 582 and multiply back towards the left

$$288 \div 51067 = 0057$$

$$8435.35 \times 19582 = .1652, \text{ etc.}$$

Convert the cwt. to decimals mentally by multiplying by 5.

Add quantities of each grade shipped.

At the close of the month, cross-add the quantities of each grade shipped for the monthly total.

Cross-add the totals and prove against the sum of the "cross-totals"

Then figure the percentages on the month's shipment in same manner as the daily.

### DAILY REPORT FOR CONCENTRATING PLANT

This report contains the number of cars Hoisted for the day and the Tons. The Preliminary work for this report is: The totaling of the number of cars, and adding the quantities hoisted in each car.

## MISSOURI LEAD & ZINC COMPANY.

### CONCENTRATING PLANT.

Report for 24 hours ending

*Wednesday 12 M*

*Feb 7.*

1902

MILL No.	HOISTED		RATE	AMOUNT	Hours	NAME	REMARKS
	CARS	Tons					
2	46	126.5	.78	98 67	14	Davy #2	
3	37	99.	.86	85 14	12	" #1	
1	48	132.	.72	95 04	16	Yellow Dog	
	131	357.5		278 85			

#### COMPTOMETER WORK ON THE REPORT

Add the cars, 46, 37, 48 = 131 cars hoisted in the day.

Add the tons, 126.5, 99, 132 = 357.5 Tons mined in the day.

Extend the Tons by the Rate, holding the rates for Key Factors,

$$126.5 \times .78 = \$98.67, \text{ etc.}$$

Add the amounts = 278.85

To Prove: Accumulate the extensions,

$$126.5 \times .78$$

$$99. \times .86$$

$$132. \times .72$$

$$\underline{\$278.85}$$

Proving against the Extension Total.

## CONCENTRATING PLANT INVOICE

The rates are usually by the Net Ton.

In the above—

Royalty on the Jack is figured at 20%.

Royalty on the Lead is figured at 25%.

To reduce to equivalent of Net Ton:

Divide the price by 2 and point off 3 places.

Joplin, Missouri, Feb 7, 1912				
<b>MISSOURI LEAD AND ZINC CO.</b>				
IN ACCOUNT WITH <i>W. J. Gittstrap</i>				
			TOTAL	ROYALTY
Sold.	325	lbs Jack @	40 <sup>00</sup>	10.50
Sold.	120	lbs Lead @	22 <sup>00</sup>	2.64
				8.84
				2.52

## METHOD

Hold one-half of the price for Key Factor and multiply the weight and point off.

$$.525 \times 20 = \$10.50$$

Leave this in the Register and multiply by the Royalty, 20% (3 Factor Way) = 2.10.

Leave this in the Register and make a negative subtraction of 10.50 = the Net, \$8.40.

Pay you this day.

10.92
3.80
7.12

Figure the Lead in the same manner, = .84, Royalty and 2.52 Net.

Add the charges, = 3.80

Clear and add the "Nets," ..... = 10.92

And subtract out the charges ..... 3.80

Equals amount of remittance ..... 7.12



# **CONCENTRATING PLANT SALES RECORD**

This contains the Weight, Price and Extensions and a summary of the cost records:

JOPLIN CHATTING CO.			
Sales Record		No. 475	
Buyer	W. M. Jones	Date	Feb 7 1912
	lbs. @	\$40.00	93520
Jack	46760	lbs. @	
Jack		lbs. @	
Lead	675400	lbs. @ 28.00	945560
			1039080
	23.4		
	337.7		
Tons	361.1		
	Cost	34675	
	Hauling	2600	
	Milling	18500	
	Expense	86545	
	Total	142320	\$142320
			\$896760

## **METHOD**

First add the summary of costs on right of Keyboard and jot down answer. Then when the extensions are completed, the total of costs are ready to be deducted.

Hold one-half the rate for Key Factor, preferably over the Fixed Decimal, and multiply the pounds—i. e., hold \$20.00 and multiply 46.760=935.20

Clear and hold \$14.00 and multiply 675.400=..... 9455.60

Leave the last extension in the register and add the amount of first extension \$35.20= 10390.80

Subtract out the Total Cost..... 1423.20

Equals the net profits..... \$8967.60

(Or—hold the rate and multiply  $\frac{1}{2}$  of the lbs., dividing by 2 mentally as you multiply).

## CAR MANIFESTS

Smelting Plants issue "Car Manifests" on shipments received. The results of the tests, i. e., per cent of Zinc, Lead, Iron, Moisture, etc., are entered on this manifest. The net quantities, weights and amounts are figured from these per cents and entered on the manifest.

CAR MANIFEST															Report No. 1	
AMERICAN ZINC, LEAD & SMELTING CO.															37684	
Shipped to <b>CANEY</b>															Shipped from	
<i>John Doe</i>															<i>Joplin, Mo.</i>	
Buyer															Date	
<i>Chicago Ill.</i>															<i>May 1<sup>st</sup> 1912</i>	
															Car No. <i>20386</i>	
															Initial <i>Mo Pac</i>	
No.	MIXER	MIX	Wet Weight	Moist.	Dry Weight	Bar	Pure	Amount	% Zn	% Pb	% Cu	% Fe	% Moist.	Zinc Contents	Iron Contents	Date of Purchase
300	<i>Mercantile Mine</i>		87640	3070	84570	5200	4850	2050	82	5850	150		350	49470	1270	4/28
<div style="display: flex; justify-content: space-between;"> <span>16472010978153 722</span> <span>#380245</span> <span>80662 2200</span> </div>																
<div style="display: flex; justify-content: space-between;"> <span>4909</span> <span>586527</span> <span>810 18119</span> </div>																
<div style="display: flex; justify-content: space-between;"> <span></span> <span>567208</span> <span></span> </div>																

**CAR MANIFESTS—Continued****COMPTOMETER WORK**

**The Unit of Weight is 10 lbs.**

**Determine Weight of Moisture**

Hold the Moisture per cent, .035, for Key Factor and Multiply the **Wet Weight**, 87640=3070 lbs. **Moisture**.

**Determine the Dry Weight**

Hold the net per cent of moisture, .965, for Key Factor and multiply the **Wet Weight**, 87640=84570 lbs. **Dry Weight**.

**Prove Moisture and Dry Weight**

With the Dry Weight, 84570 lbs., in the register, add to it the Moisture, 3070 lbs.=Wet Weight, 87640 lbs.

**Determine Weight of Zinc**

Hold the Zinc per cent, .585, for Key Factor and multiply the **Dry Weight**, 84570=49470 lbs. **Zinc Contents**.

**Determine the Iron Contents**

Hold the Iron per cent, .015, for Key Factor and multiply the **Dry Weight**, 84570 lbs.=1270 lbs. **Iron**.

**Determine the Amount**

The Price will be as many dollars and cents above or below the base, as the per cent of zinc is above or below 60.

Hence, the Zinc per cent being .585, the price is \$1.50 less than the base, or \$48.50 per net ton.

Hold one-half of the price, \$24.25, for Key Factor and multiply the **Dry Weight**, 84570 lbs.= \$2050.82.

**Determine the Freight.**

The **Freight Rate** is .0468 per Cwt. Hold the rate, .0468, for Key Factor and multiply the total **Wet Weight** of the several cars, 252360 = \$118.10, amount of **Freight**.

Add the Hauling and Freight = \$181.19

Add the amounts of the several cars shipped, \$2050.82, \$3802.45 = \$5853.27. Leaving this in the register, subtract the Freight and Hauling charge, \$181.19 = \$5672.08, Net Amount.

**FREIGHT WORK**

Usually a settlement is made with the Railroad Company each month, the Railroad sending in all Expense Bills for freight received during the month together with a statement of same.

The extensions on Expense Bills and the postings on statements are all proved on the Comptometer.

The extending of weights by rates is completed on the Comptometer before the item can be placed on paper.

**EXAMPLE:**

49500 lbs. @ 67c a Net Ton.

Hold one-half of the rate, .335, for Key Factor over the Fixed Decimal and multiply the thousand lbs., 49.5 = \$16.58.

The Comptometer is worth its cost for this **Freight work alone** to say nothing about the hundreds of other uses.

## STATEMENT OF RESULTS

This statement is compiled to show the costs per ton for the several operations and the percentage relation of the totals.

ARGENTINE CONSOLIDATED MINING CO.			
STATEMENT OF RESULTS		FOR MONTH OF FEBRUARY, 1910	
Tons of Rock Mined . . .	129,238		
Tons Rock Hoisted . . .	123,150	Total Expense,	
Tons Rock Stamped . . .	119,844	as below . . . . .	\$169,455.36
Cost per Ton Rock Mined	1.24 <sup>310</sup>	Total Construction	3,646.55
Cost per Ton Rock			
Hoisted . . . . .	1.30 <sup>455</sup>		\$173,101.91
Cost per Ton Rock			
Stamped . . . . .	1.34 <sup>054</sup>	Cost per Pound	
Pounds Mineral Copper		Refined . . . . .	8 <sup>4619</sup> Cents
Produced . . . . .	2,715,361		
Pounds Refined Copper			
Produced . . . . .	2,045,658		
Per Cent Mineral in			
Rock Stamped . . . . .	1 <sup>1327</sup>		
Per Cent Refined in Rock			
Stamped . . . . .	00 <sup>8335</sup>		
Per Cent Refined Copper			
in Mineral . . . . .	75 <sup>3365</sup>		
Total Costs at Mine . . . . .	\$153,955.24		
Add Monthly Proportion Taxes . .	6,700.00		\$ 160,655.24
Total Costs at Smelter . . . . .			8,800.12
Total Costs on Dock at Dollar Bay			\$ 169,455.36
Cost per Pound Refined Copper on Dock . . .	8 <sup>2837</sup> Cents		
	Mich., March 22nd, 1910		
		Clerk.	

## METHOD

Find Costs per Ton Rock Mineral  
Rock Hoisted  
Rock Stamped

Add in the Comptometer at the left,  
The Total Cost at Mines . . . . . \$160,655.24  
Divide this by the quantity of  
Rock Mined, 129,238 . . . . . = 1.24<sup>310</sup>  
Then by quantity of Rock Hoisted,  
123,150 . . . . . = 1.30<sup>455</sup>  
And by quantity of Rock  
Stamped, 119,844 . . . . . = 1.34<sup>054</sup>

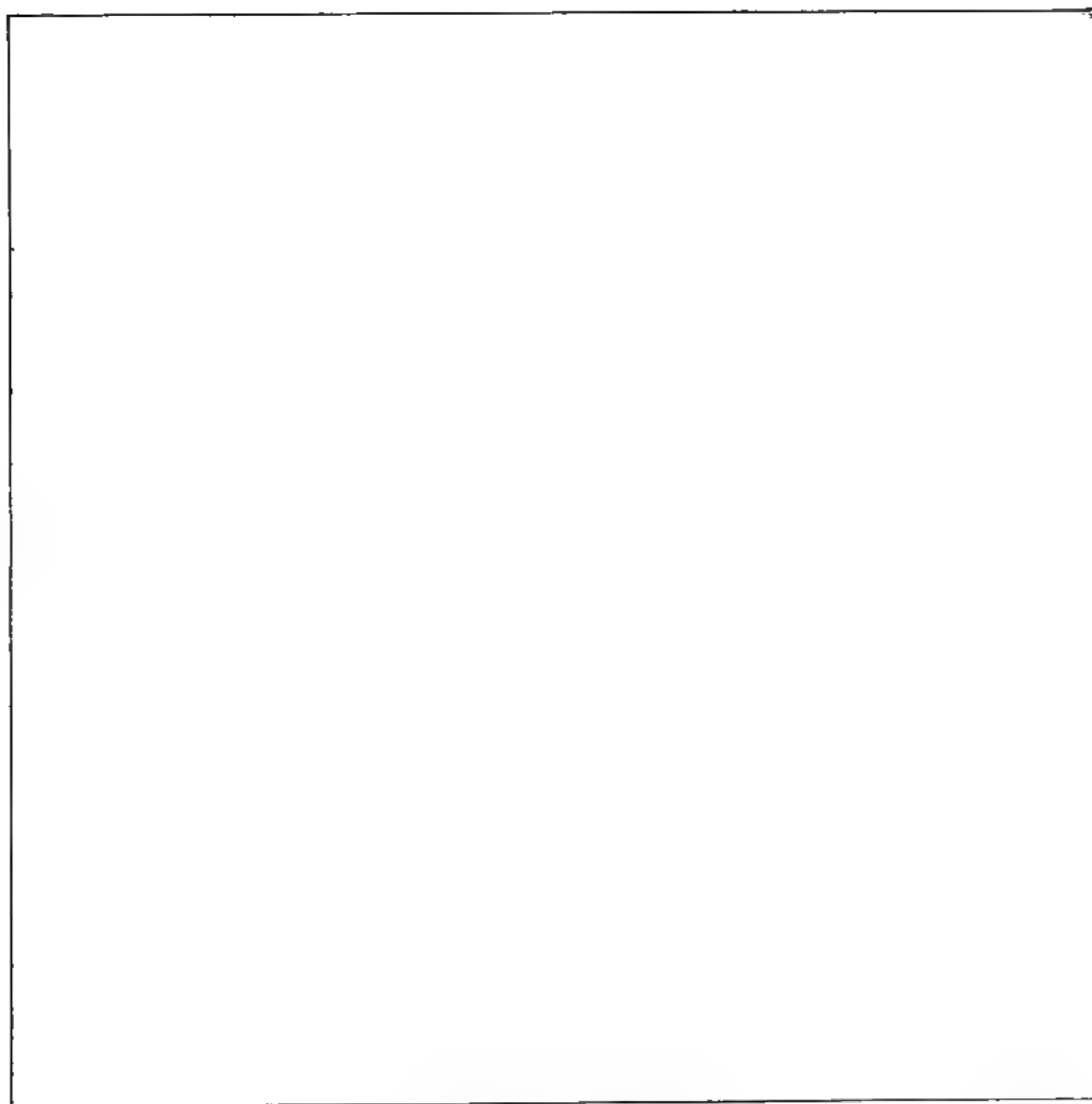
Find the Refined Copper Costs—  
On the Dock  
Including Construction.

Add the "Total Expense," \$169,455.36, in the  
Comptometer at the left and divide by "Refined  
Copper," 2,045,658 . . . . . = \$.08<sup>2837</sup>  
Then add in the Grand Cost \$173,101.91 and  
divide by the "Refined Copper," 2,045,658, = \$.08<sup>4619</sup>

Find the Per Cents of  
Mineral Rock Stamped  
Refined Rock Stamped  
Refined Copper in Mineral.

Add the pounds mineral produced . . . . . 2,715,361,  
in the Comptometer at the left and divide  
by the lbs. stamped (119,844 × 2000 = 239,-  
688,000) . . . . . = 1.1329%  
Divide the Refined Copper in Mineral . . . 2,045,658  
by the lbs. Stamped (119,844 tons × 2000  
= 239,688,000 lbs.) . . . . . = .8532%  
Divide the Refined Copper, 2,045,658, by  
Mineral Copper produced, 2,715,361 . . . = 75.3365%

**ENGINEERING**



**ENGINEERING, OR FRACTIONAL, MODEL COMPTOMETER**  
Showing Inch and Fractional Columns

## ENGINEERING

The work of the Engineer is so varied and so different in the different classes of engineering that we will attempt to show only a portion of the Comptometer work.

The volume, variety and peculiarity of the work in the Engineering Field called for a special machine,—one that would add and accumulate feet, inches and fractions of an inch in the one operation.

Mr. Felt designed the "Engineering Model," shown on the opposite page, to meet these requirements. This model is especially adapted to the use of Architects, Building Contractors and Steel Fabricators, as well as to the Engineering Profession.

Soon after installing one of the Engineering Models, a prominent Chicago Architect had occasion to check a set of building plans containing a large number of detail measurements. The work had been revised by two mental checkers and passed as correct. But the Comptometer uncovered a dozen or more errors; thus, as a safeguard against mistakes, the Comptometer was proven invaluable.

### SOME USES FOR THE COMPTOMETER BY MECHANICAL ENGINEERS

#### A. Computations involving the principles of Mechanics, such as—

Center of Gravity;  
Moment of Inertia;

Center and Radius of Gyration;  
Centers of Oscillation and of Percussion;  
The Pendulum;  
Centrifugal Force;  
Velocity; Acceleration; Falling Bodies;  
Mass; Momentum; Work.

#### B. Computations involving the Laws of Mechanics as applied to Machines, such as—

Lever, Wedge, Screw, Inclined Plane, Pulleys, Gears, etc.

#### C. Computations involved in Tabulating Data and Compilation of Comparative Statistics, such as—

Summary of Output, Losses, etc.

### SOME USES OF THE COMPTOMETER BY CIVIL ENGINEERS AND ARCHITECTURAL ENGINEERS

Civil Engineers and Architectural Engineers are using the Comptometer for calculating:—

Properties of Sections;  
Bending and Breaking Moments; Deflections;  
Strength of Materials;  
Weight of Materials;  
Thrust of Arches; Stress in Trusses;  
Floor and Roof Loads;  
Estimating Length, Weight and Cost of Materials;  
Estimating Surfaces, Volumes, etc.

### ADDING DETAIL MEASUREMENTS

This section of Detail Measurements of Building Plan illustrates a use for the Engineering Model Comptometer.

Adding ①—②:

Wanted: The total of detail measurements between (1) and (2).

Add the various detail measurements, as indicated, in feet, inches and fractions of an inch. Each denomination is automatically converted into the next higher, while adding.

	3'	6"	$\frac{1}{2}"$
	14'	8"	$\frac{1}{2}"$
One-half ) 1'	6"		
of 3' 6 $\frac{1}{2}"$ )	3"	$\frac{1}{4}"$	
The Register shows	20'	$\frac{1}{4}"$	

This plan shows the measurement between 1 and 2 for the main building line to be 20'-0".

Adding the several measurements amounts to 20'  $\frac{1}{4}"$ .

This is because the corner extends  $\frac{1}{4}"$  beyond the main building line as shown by the arrow at 1.

Adding ①—③

4'	11"	$\frac{1}{2}"$
2'	1"	$\frac{5}{8}"$
4'	8"	
	21"	
2'	4"	
2'	5"	$\frac{3}{4}"$
The Register shows	18'	3" $\frac{7}{8}"$

Adding ③—④

2'	5"	$\frac{3}{4}"$
2'	4"	$\frac{1}{2}"$
	21"	
4'	8"	
	21"	
4'	8"	
2'	5"	$\frac{3}{4}"$
The Register shows	20'	2" 0"



## 10 and 100 and 1000 Times Inches and Fractions to Eighths

No. 8

THIS TABLE IS FOR USE WITH THE ENGINEERING MODEL.

	0"	1"	2"	3"	4"	5"	6"	7"	8"	9"	10"	11"
—		0-10	1-8	2-6	3-4	4-2	5-0	5-10	6-8	7-6	8-4	9-2
		8-4	16-8	25-0	33-4	41-8	50-0	58-4	66-8	75-0	83-4	91-8
		83-4	166-8	250-0	333-4	416-8	500-0	583-4	666-8	750-0	833-4	916-8
$\frac{1}{8}$	0-14	0-114	1-94	2-74	3-54	4-34	5-14	5-114	6-94	7-74	8-54	9-34
	1-04	9-44	17-84	26-04	34-44	42-84	51-04	59-44	67-84	76-04	84-44	92-84
	10-5	93-9	177-1	260-5	343-9	427-1	510-5	593-9	677-1	760-5	843-9	927-1
$\frac{1}{4}$	0-24	1-04	1-104	2-84	3-64	4-44	5-24	6-04	6-104	7-84	8-64	9-44
	2-1	10-5	18-9	27-1	35-5	43-9	52-1	60-5	68-9	77-1	85-5	93-9
	20-10	104-2	187-6	270-10	354-2	437-6	520-10	604-2	687-6	770-10	854-2	937-6
$\frac{3}{8}$	0-34	1-14	1-114	2-94	3-74	4-54	5-34	6-14	6-114	7-94	8-74	9-54
	3-14	11-54	19-94	28-14	36-54	44-94	53-14	61-54	69-94	78-14	86-54	94-94
	31-3	114-7	197-11	281-3	364-7	447-11	531-3	614-7	697-11	781-3	864-7	947-11
$\frac{1}{2}$	0-5	1-3	2-1	2-11	3-9	4-7	5-5	6-3	7-1	7-11	8-0	9-7
	4-2	12-6	20-10	29-2	37-6	45-10	54-2	62-6	70-10	79-2	87-6	95-10
	41-8	125-0	208-4	291-8	375-0	458-4	541-8	625-0	708-4	791-8	875-0	958-4
$\frac{5}{8}$	0-64	1-44	2-24	3-04	3-104	4-84	5-64	6-44	7-24	8-04	8-104	9-84
	5-24	13-64	21-104	30-24	38-64	46-104	55-24	63-64	71-104	80-24	88-64	96-104
	52-1	135-5	218-9	302-1	385-5	468-9	552-1	635-5	718-9	802-1	885-5	968-9
$\frac{3}{4}$	0-74	1-54	2-34	3-14	3-114	4-94	5-74	6-54	7-34	8-14	8-114	9-94
	6-3	14-7	22-11	31-3	39-7	47-11	56-3	64-7	72-11	81-3	89-7	97-11
	62-6	145-10	229-2	312-6	395-10	479-2	562-6	645-10	729-2	812-6	895-10	979-2
$\frac{7}{8}$	0-84	1-64	2-44	3-24	4-04	4-104	5-84	6-64	7-44	8-24	9-04	9-104
	7-34	15-74	23-114	32-34	40-74	48-114	57-34	65-74	73-114	82-34	90-74	98-114
	72-11	156-3	239-7	322-11	406-3	489-7	572-11	656-3	739-7	822-11	906-3	989-7

Form No. 8

## TABLES FOR USE WITH THE ENGINEERING MODEL COMPTOMETER

The Engineering Model Comptometer multiplies feet, inches and fractions of an inch, and shows the result in the same denominations.

## EXAMPLE:

What is the total length of 37 I-Beams, each 15' 7 $\frac{1}{8}$ " long?

## Fractional Method, with Engineering Model:

Hold the 7" and the  $\frac{5}{8}$ " keys and multiply seven times.

Then hold the 6' 4" and  $\frac{1}{4}$ " keys (ten times 7 $\frac{1}{8}$ ". See Table), and multiply three times.

Then hold the 37' keys and multiply 15 = Answer, 578' 6 $\frac{1}{8}$ ".

or —

Decimal Method, with regular Decimal Model; or an Engineering Model, but not using the Fractional Columns.

Use the Table No. 3, giving Decimal Parts of a foot for each  $\frac{1}{8}$  inch.

Hold 37 for Key Factor over the Fixed Decimal and multiply 15.6354, (reading the decimal .6354 from table as you multiply), = 578.5098 ft.

Convert the Decimal. Clear the Register; hold the decimal .5098 for Key Factor at right of Keyboard and multiply by 12 = 6.1176, or approximately 6 $\frac{1}{8}$  ins.

or —

Find on the Table No. 3 the nearest decimal to .5098, which is .5000 and equals 6 $\frac{1}{8}$ ". Therefore, answer is 578' 6 $\frac{1}{8}$ ".

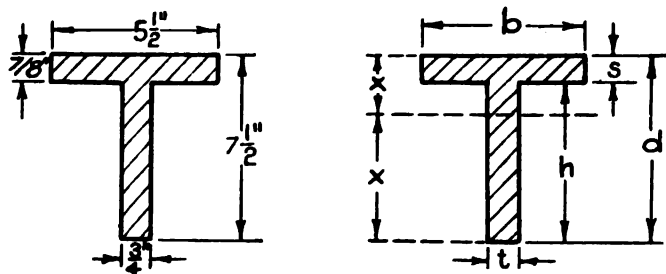
DECIMALS OF A FOOT FOR EACH  $\frac{1}{8}$  OF AN INCH TO BE USED IN CONNECTION WITH THE COMPTOMETER IN FIGURING LUMBER, STEEL BEAMS, ANGLES, ETC.

No. 3

	0"	1"	2"	3"	4"	5"	6"	7"	8"	9"	10"	11"
		.0833	.1667	.2500	.3333	.4167	.5000	.5833	.6667	.7500	.8333	.9167
$\frac{1}{8}$ "	.0104	.0938	.1771	.2604	.3438	.4271	.5104	.5938	.6771	.7604	.8438	.9271
$\frac{1}{4}$ "	.0208	.1042	.1875	.2708	.3542	.4375	.5208	.6042	.6875	.7708	.8542	.9375
$\frac{3}{8}$ "	.0313	.1146	.1979	.2813	.3646	.4479	.5313	.6146	.6979	.7813	.8646	.9479
$\frac{1}{2}$ "	.0417	.1250	.2083	.2917	.3750	.4583	.5417	.6250	.7083	.7917	.8750	.9583
$\frac{5}{8}$ "	.0521	.1354	.2188	.3021	.3854	.4688	.5521	.6354	.7188	.8021	.8854	.9688
$\frac{3}{4}$ "	.0625	.1458	.2292	.3125	.3958	.4792	.5625	.6458	.7292	.8125	.8958	.9792
$\frac{7}{8}$ "	.0729	.1563	.2396	.3229	.4063	.4896	.5729	.6563	.7396	.8229	.9063	.9896

## CIVIL AND ARCHITECTURAL ENGINEERING

The calculations in figuring stresses are quickly and accurately performed on the Comptometer. A designer in the bridge department of a Western railroad does three times as much work with the 12 Column Comptometer as by any other method—and with accurate results. The following is typical of the kind of work and the manner of using the Comptometer in figuring moments for stresses and strains data.

**Properties of Sections.****EXAMPLE:**

A = Area of section . . . . . = 9.78125 sq. in.  
 X = Distance of neutral axis from  
     top of section . . . . . = 2.3434 in.  
 x = Distance of neutral axis from  
     bottom of section . . . . . = 5.1576 in.  
 I = Moment of Inertia . . . . . = 52.8588  
 S = Section Modulus . . . . . = 10.2487  
 r = Radius of Gyration . . . . . = 2.3247

**To Find the Area of Section.****FORMULA:**

$bs + ht = (5\frac{1}{2} \times \frac{7}{8}) + (6\frac{5}{8} \times \frac{3}{4}) = 4.8125 + 4.96875 =$   
 9.78125 sq. in.

**COMPTOMETER METHOD**

Use the Fixed Decimal method and multiply

$$\begin{array}{r}
 5.5 \times .875 \\
 \text{and } * 6.625 \times .75 \\
 \hline
 \text{Accumulating} = 9.78125 \text{ sq. in. area} \\
 (*d-s=h=7\frac{1}{2}-\frac{7}{8}, \text{ or } 6\frac{5}{8})
 \end{array}$$

**Find the Distances from Upper Extremity of Section to Neutral Axis.**

**FORMULA:**

$$\begin{aligned}
 X &= \frac{d^2t + S^2(b-t)}{2A} = \frac{(7\frac{1}{2} \times \frac{3}{4}) + (\frac{7}{8} \times 5\frac{1}{2} - \frac{3}{4})}{2 \times 9.78125} \\
 &= \frac{42.1875 + 3.6367}{19.5625} = 2.3424
 \end{aligned}$$

The distances from the lower extremity to the Neutral Axis will be the difference between the full distance, 7.5", and 2.3424", or 5.1576".

**COMPTOMETER METHOD**

Square 7.5 on right side of Keyboard = 56.25  
 Multiply this by .75 (using 3 factor  
     method) . . . . . = 42.1875  
 Note this result and clear the machine.  
 Square .875 . . . . . = .7656 +  
 Leave in machine and multiply by  
      $(5\frac{1}{2} - \frac{3}{4})$  or  $4\frac{3}{4}$  (Three factor way) . . = 3.6367  
 Add to this the first quantity . . . . . 42.1875  
   45.8242  
 And divide by 19.5625 . . . . . = 2.3424  
 As the answer is wanted to the 5th figure, use the  
 6 figures of Divisor.

## PROPERTIES OF SECTIONS

### Determine the Moment of Inertia.

FORMULA:

$$\frac{tx^3 + bx^3 - (b-t)(x-s)^3}{3} =$$

$$\frac{(\frac{3}{4} \times 5.1576^3) + (5\frac{1}{2} \times 2.3424^3) - (5\frac{1}{2} - \frac{3}{4}) \times (2.3424 - \frac{7}{8})^3}{3}$$

$$\frac{102.8972 + 70.6876 - 15.0085}{3} = 52.8588$$

#### COMPTOMETER METHOD

This involves a number of long multiplications, such as raising 5.1576 to the 3d power.

In multiplying these long factors, it is better to work from the left of the Keyboard and clear the machine after each calculation.

Carry out to the 4th full decimal.

#### METHOD

$Tx^3$ , i. e.,  $\frac{3}{4} \times 5.1576^3$ .

From the left of Keyboard,  
multiply  $5.1576 \times 5.1576 = 26.6008$

Clear and multiply this  
result by 5.1576..... = 137.1963 (the 3d power  
of 5.1576)

Clear and multiply this  
item by .75..... = 102.8972

$BX^3$

Raise X - 2.3424 to the  
3d power in the same  
manner..... = 12.8523

And multiply by 5.5..... = 70.6876

$(b-t) \times (X-s)^3$   
Add X in the Fixed Decimal position, 2.3424  
And subtract..... .875  
= 1.4674

Raise this factor to the  
3d power as before.... = 3.1597

Multiply this result by  
4.75 (which represents  
 $(b-t)$ ..... = 15.0085

Now having determined  
each prime factor, use  
the Fixed Decimal and  
add.....

$$\begin{array}{r} 102.8972 \\ 70.6876 \\ \hline 173.5848 \\ 15.0085 \\ \hline 188.5933 \end{array}$$

And divide by 3..... = 52.8588, Moment of Inertia

These computations being completed in one continuous operation without clearing.

### Determine the Section Modulus.

FORMULA:

$$\frac{I}{d - X} = \frac{52.8588}{7\frac{1}{2} - 2.3424} = 10.2487$$

#### COMPTOMETER METHOD

Merely add d in the Fixed Decimal position, 7.5

And subtract X..... 2.3424

Clear and add, on the..... 5.1576

left of Keyboard, the  
Moment of Inertia... 52.8588

And divide by 5.1576... = 10.2487, the Section  
Determine the Radius of Gyration. Modulus.

FORMULA:

$$\sqrt{\frac{I}{A}} = \sqrt{\frac{52.8588}{9.78125}} = \sqrt{5.4041} = 2.3247$$

#### COMPTOMETER METHOD

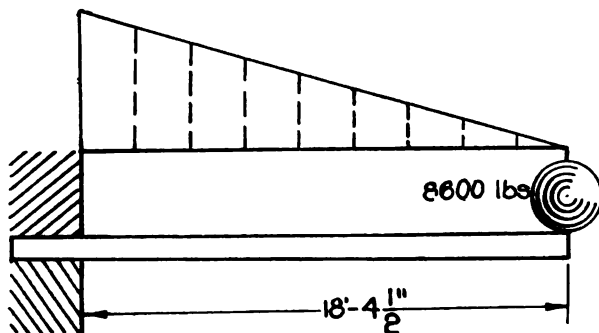
Add 52.8588 in on the left and Divide by  
9.78125, splitting the Divisor in each  
position, holding first small—781. Then,  
with right hand, use the remaining keys,  
small 24..... = 5.4041  
Leave this in the machine and proceed to  
extract the **Square Root** (see "Sq. Root.")  
Equals Radius of Gyration..... = 2.3247

## STRENGTH OF MATERIALS

## FINDING BENDING MOMENTS

## EXAMPLE:

A beam 18' 4½" long is fixed at one end and unsupported at the other. A load of 8600 lbs. is concentrated at the free end.



What is the Maximum Bending Moment in inch pounds, at point of support?

$$Pl + \frac{Wl}{2} \text{ in which } P = \text{Load in lbs.}$$

$l$  = Length of span in inches.

$W$  = Total weight of Beam in lbs.

A 12 column Comptometer will work this out to the last decimal.

## FORMULA:

$$\left( \frac{8600 \text{ wt.} \times 220.5 \text{ inches lgth.}}{2} + \left( \frac{55 \text{ wt. per ft.} \times 18\frac{3}{4} \text{ lgth.} \times 220.5 \text{ inches lgth.}}{2} + 2 \right) \right) =$$

Maximum Bending Moment in inch pounds at point of support.

## METHOD

The last statement should be figured first; then, with the Fixed Decimal Method, accumulate the product of the first.

Commence at the right of Keyboard. Hold 220.5 for the Key Factor and multiply 18.375, equals 4051.6875

Leave this in the machine and multiply by one-half of 55 or 27.5.

(Or multiply by 55 and divide result by 2.)

Use "Three Factor Method" (p. 39) = 111,421.40625

Leave result in the machine. Use the decimal, where located, as a Fixed Decimal, and multiply the weight by the length in inches, = 2,007,721.40625, Bending Moment in Inch Pounds.

Find the transverse strength of flagging (flooring).

EXAMPLE: (From Kent's "Mechanical Engineer's Pocket Book.")

Bluestone Flagging, 72" wide  $\times$  8" thick, resting on 36" centers, 32" in the clear. What is the breaking load?

## FORMULA:

$$\frac{\text{Width} \times \text{Square of thickness}}{\text{Span in clear.}} \times .744 (*) = \text{The Breaking Load at center of span.}$$

## METHOD

Square the thickness, 8, on the right side of Keyboard..... 64

Leave this in the machine and multiply by 72 ("Three Factor Method," p. 39)... 4608

Then continue and multiply by .744, ("Three Factor Method")..... 3428.352

Leave this result in the machine and divide by 32..... 107.136

Net Tons, Breaking Load.

The final result is obtained without clearing the machine or jotting down any intermediate result.

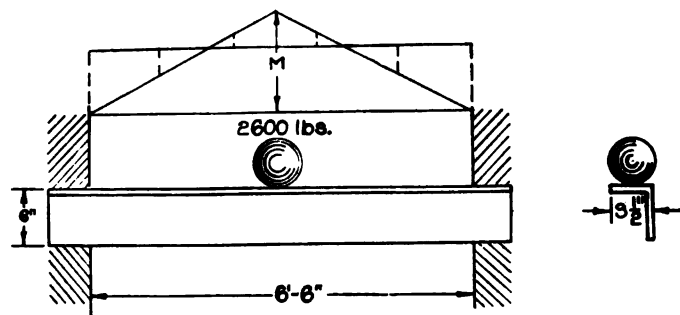
\* .744 is the percentage of strength Bluestone sustains to Glass, which is used as a standard.

## FIGURING STRESSES

Find the stress in inch pounds in an angle.

EXAMPLE:

An angle  $6'' \times 3\frac{1}{2}'' \times \frac{1}{8}''$  and 6'6" long, weighing 24 lbs. per foot is loaded at the centre with a 2600 lb. weight, the 6" leg being placed vertically.



FORMULA:

$$\frac{\text{Load} \times \text{Length in inches}}{4 \text{ (Constant)}} + \frac{\text{Total Weight of Beam}}{\text{Weight per ft.} \times \text{length} \times \text{length in inches}} \div 8 \text{ (Constant)}$$

and this result divided by 6.55 = Fibre stress in inch pounds.

## METHOD

Multiply length in inches,  $78 \times$  load, 2600, = 202800 and divide by 4 ..... = 50700

(Or multiply by Reciprocal .25, 3-Factor Method.)

Clear the machine and multiply, wt. per foot,  $24 \times$  length,  $6\frac{1}{2} \times$  length in inches, 78 ..... = 12168

(Using "Three Factor Method.")

Now divide this result by 8, (or better, multiply by its reciprocal, .125)

("Three Factor Method") ..... = 1521

Add to this the result of the first part of equation ..... = 52221

Stress in inch pounds at the angle.

Or,—

First determine the result of second part of equation

$$\frac{24 \times 6\frac{1}{2} \times 78}{8} = \dots\dots\dots = 1521$$

(Canceling 8 into 24 leaves a straight multiplication of  $3 \times 6\frac{1}{2} \times 78$ .)

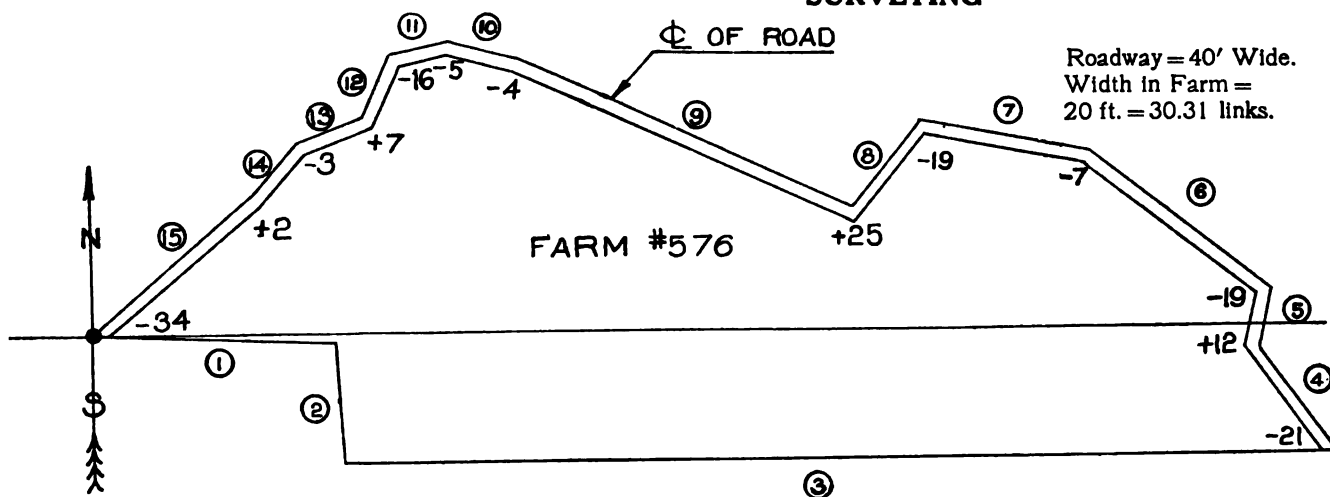
Leave this in the machine, and, with the Fixed Decimal Method, multiply 78 by 2600/4, dividing 2600 by 4 mentally as you multiply ..... = 52221

To determine the stress per square inch—

Leave the inch pounds in the machine and divide by the established constant, 6.55 ..... = 7973 lbs.

Stress per square inch.

## SURVEYING



## Survey of An Irregular Farm.

This problem will well illustrate the variety of practical and efficient Comptometer application to the Engineering Problems.

Working up this data mentally would consume much gray matter, energy and 300% to 500% more time.

No. of Course	Latitude	Departure	Middle Distance	Area	Bearing	C. L. Distance	Side Line Distance
1	-11	+873	436.5	-4,801.5	S 89° - 13' E	873.07	873.07
2	-391	+7	876.5	-342,711.5	S 1° - 8' E	391.06	391.06
3	-11	+3,041	2,400.5	-26,405.5	S 89° - 44' E	3,041.02	3,041.02
4	+384	-259	3,791.5	+1,455,936.0	N 34° - 0' W	463.18	448.18
5	+165	+23	3,673.5	+606,127.5	N 8° - 0' W	166.60	163.10
6	+121	-598	3,386.0	+1,425,506.0	N 54° - 53' W	731.33	718.33
7	+83	-528	2,823.0	+234,309.0	N 81° - 3' W	534.48	521.48
8	-204	-143	2,487.5	-507,450.0	S 35° - 2' W	249.13	252.13
9	+466	-1,077	1,877.5	+874,915.0	N 66° - 37' W	1,173.49	1,183.99
10	+38	-226	1,226.0	+46,588.0	N 80° - 20' W	229.17	224.67
11	-30	-189	1,018.5	-30,555.0	S 80° - 50' W	191.37	180.87
12	-187	-94	877.0	-163,999.0	S 26° - 41' W	209.29	204.79
13	-140	-195	732.5	-102,550.0	S 54° - 20' W	240.05	242.05
14	-158	-145	562.5	-88,875.0	S 42° - 30' W	214.45	213.95
15	-425	-490	245.5	-104,125.0	S 49° - 04' W	648.63	615.63
+	1,557	3,944	2,450	+4,643,381.5		9,356.32	9,274.32
-	1,557	3,944		-1,371,472.5			
				32.71909 Acres		5,051.17	4,969.17
				1.51858 " in Roadway			
				31.20051 " Net, in Farm		Net C. L. D.	Net S. L. D.

C. L. D. and S. L. D. of Roadway

## SURVEYING—Continued

The Latitudes and Departures are determined by actual measurement.

Thus we have:

The number of the courses.

The Latitudes.

The Departures.

Wanted:

Area of Farm (to center Line of road)

Bearings.

Distances of the courses.

Length of side line of road for each course.

## METHOD

1st: The + and — Latitudes and the + and — Departures must be equal; so first prove same by adding the + Latitudes on the right of Keyboard and the — Latitudes on the left of Keyboard and see that they balance.

Balance the Departures in the same manner.

**Figure the Middle Distances. FORMULA:**

Add separately the previous + Departures and the previous — Departures. Find the difference between these sums and add or deduct (as indicated) one half of the present Departure.

**EXAMPLE: Course 8.**

Add the previous Plus and Minus Departures and one half of the departure for course being figured, to separate totals:—

Add Minus Departures on the left of Keyboard	$\begin{array}{r} -259 \\ -598 \\ -528 \\ -71.5^* \\ \hline 1456.5 \end{array}$	Add the Plus Departures at the right of the Fixed Decimal	$\begin{array}{r} +873 \\ +7 \\ +3041 \\ +23 \\ \hline 3944 \end{array}$
--	---	---	--

\*One-half of course 8

Now without clearing, subtract the sum of the — Departures, 1456.5, from the + Departures, equals 2487.5 links, the middle distance.

**2d: Find the Area. FORMULA:**

Multiply the Middle Distance by the Latitude.

**EXAMPLE: Course 8.**

Multiply from the right, the middle distance 2487.5 by the Latitude — 204, using the latter for Key Factor, equals —507450.0 links, the Area.

**3d: Find the Area of the Farm.**

Add the — areas first, 4801.5, —342711.5, etc. . . . . = 1,371,472.5

Clear the machine.

Then add the + areas, 1455936, 606127.5, etc. . . . . = 4,643,381.5

The larger amount or + areas is now in the machine ready to subtract the previously determined — areas. Subtract 1371472.5 . . . . . = 3,271,909 sq. links Area of Farm.

**4th: How Many Acres in the Farm?**

As one acre contains 100,000 sq. links, point off 5 places = 32.71909 acres.

**5th: Find the Center Line Distances. FORMULA:**

The square root of the square of the Latitude plus the square of the Departure = C. L. D.

$$\text{Or } \sqrt{-\text{Latitude}^2 + \text{Departure}^2}$$

**EXAMPLE: Course 8.**

Use the Fixed Decimal and accumulate. This will leave the result in position to extract the Square Root.

$$\begin{array}{r} 204 \times 204 \\ 143 \times 143 \\ \hline 62065 \end{array}$$

Extract the Square Root of 62065, carrying out to the second full decimal = 249.13.

(See "Square Root" for Method)

## SURVEYING—Continued

### 6th: Find the Side Line Distances of Courses.

The small figures inside of Roadway represent the difference in lengths between the Center and the Side Line Distances on account of the Angles.

If the junction of the lines forming the Angle projects towards the farm, it increases the distance, therefore the corresponding number is +.

If the reverse is true, the number is -.

**FORMULA:** Add to or subtract from the **Center Line Distance** one half of the sum, or one half of the difference between the numbers at the angles of the course.

**EXAMPLE:**

#### Course 4 (Courses 1, 2, and 3 have no Roadway).

In courses 4 and 15 there is no other course to share the extremes; hence, the full distance is taken at the end of the road and one half of the next, which is shared with the next course.

Add C. L. D. in the Comptometer in

Fixed Decimal position.....	463.18
Add to same $\frac{1}{2}$ of +12 .....	6.
	<u>469.18</u>
Now subtract.....	-21.
Equals Side Line Distance .....	<u>448.18</u>

#### EXAMPLE: Course 5.

Add C. L. D. in Fixed Decimal position..	= 166.6
The difference between -19 and +12 is -7; therefore subtract $\frac{1}{2}$ of -7 .....	- 3.5
Equals S. L. D. ....	= 163.1
Or add $\frac{1}{2}$ of 12 (166.6+6) .....	= 172.6
And subtract $\frac{1}{2}$ of 19 .....	9.5

### Length of Side Lines on the Roadway.

Add the Side Line Distances from courses 4 and 15, inclusive. = 5051.17 links

And multiply by 7.92, inches per link, (3 Factor way)..... = 40005.27"

Reduce this to feet and inches, i. e., leave in the machine and divide by 12, stopping at the decimal..... = 3333 ft. 9"

### 7th: Find the Bearing.

**FORMULA:** Divide the Departure by the C. L. D. = the Sine of the Angle.

From this read the Degrees and Minutes from the Table of Trigonometric functions found in any Engineer's Hand Book.

#### EXAMPLE: Course 13.

Add the Departure 195 at the left of Keyboard.

Divide by the C. L. D. 240.05, carrying out 6 places..... = .812331

The nearest Sine in tables is .812423, showing equivalent to  $54^{\circ} 20'$ .

### Find the Area in the Roadway.

Add the Roadway Center Line

Distances.....5051.17

Add the Roadway Side Line Dis-

tances.....4969.17

Add these two total distances and

find the average, dividing by 2..5010.17 Links

Multiply this by the width of

Roadway in Farm, 30.31 Links = 151,858 Links

Reduce to acres, dividing by

100,000.....1.51858 Acres

### Find the Net Area of Farm. in Roadway

Add the Gross Area, in the Fixed

Decimal Position.....32.71909

Subtract the Roadway area.....1.51858

31.20051 Acres

These entire results were figured on a large size Comptometer in 54 minutes and proven in 40 minutes.

A 12-column Comptometer is best for this work.



## MINING ENGINEERING

The figuring of Volumes, Levels, Weights, Values, e.c., is made a pleasure rather than a dread. The Comptometer is of special value in the compilation of comparative tables and test data.

## EXAMPLE:

Find the flow of air in a pipe 8035 ft. long, 4" diam., 82 lb. pressure, 62° Fr.

Volume in cubic feet per minute is the result of a constant (60) multiplied by the square root of:

The pressure in pounds per square inch  $\times$  the diameter to the fifth power;

Divided by the density of the air in pounds per cubic foot times the length of the pipe;

Therefore the formula becomes:

## FORMULA:

$$Q = c \sqrt{\frac{pd^5}{wL}}$$

Q = volume in cu. ft. per min. . . . = ? (274.14)

c = a constant . . . . . = 60

p = pressure in lbs. per sq. in. . . = 82

d = diameter of pipe in in. . . . = 4

w = density of air in lbs. per cubic foot . . . . . = ? (.5006)

w<sub>1</sub> = (at 62°) . . . . . = .0761

L = length of pipe in ft. . . . . = 8035

r = ratio of atmospheric density to pressure density (basis of one) . . . . . = ? (6.5782)

A.p = Atmospheric pressure . . . . = 14.7

## Find the value of r.

$$r = \frac{P + 14.7, \text{atmos. pres.}}{14.7} = \frac{82 + 14.7}{14.7}$$

## METHOD

Add, over the Fixed Decimal, the Pressure . . 82  
and the Atmospheric Pressure . . . . . 14.7  
Equals . . . . . 96.7

(The total is now registered where the division can be continued and carried to the 4th decimal.)

Divide this by 14.7 Equals "r" . . . . . 6.5782

## Find the value of w.

$$w = r \times .0761$$

Hold .0761 as Key Factor and multiply 6.5782 = .5006

## Find the Volume, Q.

$$Q = 60 \sqrt{\frac{82 \times 4^5}{.5006 \times 8035}} =$$

Raise 4 to the 5th power; multiply 4  $\times$  4 on the right side = 16. Hold 16 over itself for Key Factor and multiply by 4 = 64, etc., until raised to the 5th power = 1024 (i.e. make 3 depressions because multiplier is in the machine once.)

Continuing, multiply by lbs. pressure, 82, in the same manner or hold 82 as Key Factor, 3 Factor Way = 83968. Clear and multiply 8035  $\times$  .5006, preferably holding .5006 as Key Factor = 4022.321.

Now clear and add in the previous result, 83968, one column from the left and divide by 4022.321 = 20.8755.

This is a very long divisor. The best way is to divide in the first position by 40, holding with the first finger of each hand, then immediately let the right hand proceed to depress the small 22 keys a corresponding number of times and then the small 31 keys. Continue in this manner for each Active Dividend.

This result will now be registered in line with the left column of Keys and ready to proceed with extracting the Square Root.

Now extract the Square Root to the third decimal = 4.569, clear, and multiply by 60, using the latter for the Key Factor = 274.14 cu. ft. per min.

## PUMPING STATION WORK

### LOG SHEET

Municipal pumping stations make a daily record of results. Usually these are made for eight-hour shifts.

The illustration on next page shows the records for one eight-hour shift, results for the three shifts and the totals for the day.

The original data furnished on the report is the engine revolutions and the several gauge readings.

Thus the reading for Engine No. 1 at the beginning of the first shift was 4,893,840, at the end of the first hour, 4,894,650, etc.

The results required are the following:

- The number of Engine Revolutions per Shift;
- The number of Gallons pumped by each Engine;
- The number of Gallons pumped by all Engines;
- Average Water Pressure;
- Average Well Gauge;
- Average Head in Feet;
- The Duty;
- The Average Daily Water Pressure and Well Gauges.

### COMPTOMETER WORK

#### Engine No. 1:

Determine the number of Revolutions per Shift:

Add in the Comptometer at the left the last reading of the shift, .....	4,901,990
Subtract the first reading, .....	4,893,840
Gives the total revolutions made during the shift.....	8,150

Prove the subtraction by adding back the first reading, 4,893,840, which result must prove against the last reading, 4,901,990.

#### Determine the Number of Gallons Pumped:

The Revolutions  $\times$  the Constant of the pumps, or theoretical pumpage in gallons per revolution, equals the gallons pumped.

Hold the Constant, 790, for Key Factor at the right of Keyboard and multiply the revolutions, 8150, = 6,438,500 gallons pumped by Engine No. 1 in this shift.

Determine the revolutions and gallons pumped for each engine in the same manner.

#### Total Gallons Pumped:

Add the gallons pumped by each engine, 6,438,500,—2,496,400, etc., = 23,040,220, Total Gallons, first shift.

#### Average Water Pressure:

Add on the right of Keyboard the hourly readings of water gauge, 39, 40, 40, etc., = 304.

Leave the amount in the register and divide by the number of readings, 8 = 38, the Average Water Pressure.

Or, instead of dividing by 8, multiply by its reciprocal, .125, 3 Factor Way.

#### Average Well Gauge:

Add the well gauge readings, 4.7, 5.0, etc., with the decimal in the Dollars and Cents position, = 33.70.

Then reduce the same as before; i. e., divide by 8, or multiply by the reciprocal .125, = 4.21.

**THE LOG SHEET**

## LOG SHEET—Continued

### Figure the Head in Feet:

A pressure of 1 lb. registered on the water gauge represents a column of water 1" square and 2.31 ft. high. Therefore, the average pressure times 2.31 ft. equals the head in feet as shown on water gauge. To this must be added the height of water gauge above Datum, i. e., above mean high water mark and average well gauge, or the height between actual water level and Datum.

### METHOD

Hold Average Water Pressure, 38, for Key Factor over the Fixed Decimal and multiply the constant, 2.31. Add to this the Average Well Gauge, 4.21 and height above Datum,  $*31.1 = 123.09$ , Head in Feet for this Shift.

### Coal and Ashes:

The coal and ashes are weighed and the weighing slips added for the total of each shift.

Determine the quantity of coal and ashes for each shift in the same manner and then the total for the day.

### Figuring the Daily Average Water Pressure and Well Gauges:

Add the average for each shift and divide by 3.

\* Shown on Log Sheet.

### Figure the Duty:

The duty is the number of pounds of water raised one foot per 100 lbs. of coal.

### Find Gallons Pumped per 100 lbs. Coal:

Add the gallons pumped, 89,240,240, in the Comp-tometer at the left and divide by the 100 lbs. of coal used in pumping, 1508, = 59178 Gals. per 100 lbs. coal.

To find actual quantity of coal used for pumpage, deduct the total of the several quantities used for other purposes, as noted under Miscellaneous Reports.

Add the quantities used for other purposes, i. e., 750, 280, etc., = 3145.

Clear and add in the total quantity of coal, 153,900 and subtract the 3145, = 150,755 (read as 1508 hundred lbs.).

### Reduce to Pounds:

Multiply by  $8\frac{1}{8}$  lbs. per gallon, i. e., hold 59178 at left of Keyboard for Key Factor, splitting on 59 and 178; using the Key Factor until carried entirely off the Keyboard, = 493,150 lbs. of water pumped per 100 lbs. of coal.

Clear and multiply this result by the head in feet, 118.98. Hold the latter for Key Factor at the left of Keyboard, splitting on 118 and 98, = 58,674,987 (read as 58,675,000 lbs. Duty per 100 lbs. coal.

## SUMMARY

The Daily Report is the summary of the totals taken from the Daily Log Sheets.

*Springfield Ave.*  
**DAILY REPORT OF OPERATION of the**  
**Pumping Station, Chicago, Ill., for the month ending** *August 31*

DATE	ENGINES RUNNING				REVOLUTIONS PER DAY				Average Gauges in Feet	Pressure in Gauges	Total Head in Feet	GALLONS WATER PUMPED PER DAY	FUEL CONSUMED PER PUMPAGE
	HOURS IN OPERATION				ENGINE No. 1	ENGINE No. 2	ENGINE No. 3	ENGINE No. 4					
	No. 1	No. 2	No. 3	No. 4									
	1	2	3	4	790	790	790	1666					
1	24	24	24	24	23590	24440	24645	20100	10.98	35.40	12522	908998 50	142425
2	"	"	"	"	23745	24980	24975	20940	11.14	34.87	12369	930424 00	148060
3	"	"	"	"	24390	24950	23925	20100	11.43	36.25	12537	913658 50	141253
4	"	"	"	"	25030	24620	24260	20550	10.78	34.37	12217	916331 00	143130
									229.93	784.60	2143.57	2,005,956,730	3,088,025
27	24	24	21.58	24	23785	24970	21780	20380	11.60	35.75	126.18	896757 30	136260
28	21:50	"	24	"	18410	24550	25460	20685	11.04	36.45	127.24	885130 10	130033
29	24	"	"	"	23255	23240	21810	19580	11.19	36.58	127.69	889572 30	139530
30	"	"	"	"	22880	23070	23890	19405	10.92	36.41	127.03	875181 30	140620
31	"	"	"	"	22050	22470	21830	18710	9.31	38.42	130.33	835715 60	140330
TOTAL	734	723	721	736	747345	743730	749425	625515	226.52	109.95	280.00	2,811,133,590	4,349,668
Grand Totals					590402550	587546200	59202150	1011021990	145.50	35.79	125.71		

*Handwritten notes:*  
 54410, 507:10, 507:45, 520:20, 540:10, 526:10, 539:10, 445:105, 5600, 1093625, 468515, 14942

The Data Wanted is:

The Total Hours of Operation for each engine for the month.

The Total Engine Revolutions per Month per Engine.

The Totals of Daily Averages of Gauges and Head.

The Average per Day, for the entire Month, of Gauges and Head.

The Total Gallons Pumped for the Month.

The Total Fuel Consumed for the Month.

The Total of the Ashes for the Month.

Add Each Column.

Figure the gallons pumped per engine; e. g., Engine No. 1—Hold

the "Constant," 790, for Key Factor and multiply the total revolutions, 747,345, = 590,402,550 Gallons Pumped by Engine No. 1.

Figure the results for the other engines in the same manner.

Figuring the Average Gauges and Head:

e. g., the average elevation of water in well.

Upon completing the adding of the daily averages, 326 52, divide it by the number of days in the month, 31 = 10.53, the average per day for the month.

Determine the other averages in the same manner.

**PUMPING RECORD FOR THE YEAR 1907—CITY PUMPING STATION, HARRISBURG, PA.**

Comptometer Method on opposite page.

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## COMPTOMETER OPERATION ON PUMPING RECORD

The ease of Comptometer addition will be especially appreciated in handling these columns of large items. Each column can be added and proven on the Comptometer more quickly than one mental addition by the average clerk.

### METHOD

In working up this Pumping Record, proceed as follows:

- 1st. Add the "Hours and Minutes."  
Add the minutes first, equals.....248  
Divide by 60, equals.....4 hours 8 Min's  
Then, continuing, add the hours on the next three columns of Keys, equals.....  
.....8353 hours 8 Min's
- 2d. Divide the "Hours and Minutes" for each month by the number of days in the month, to obtain the "Average Hours and Minutes Per Day."

### Obtaining the "Average Time Per Day."

Add the hours, 716, in the Fixed Decimal position, and the minutes, 45, at the right of Keyboard.  
Divide the hours by the number of days in the month, 31, stopping at the Fixed Decimal, .....23, Rem. 3  
Convert the remaining hours, 3, into minutes on the right side of Keyboard; i. e., 3 hours times 60 minutes, (accumulating with the minutes already in the machine), equals a total.....225 minutes  
Divide the minutes by the days of the month, 31, gives the final answer.....23 hrs. and 7 min's.

### Obtain the "Daily Average for the Year."

Add the "Average Time Per Day" and divide by 12.

### Obtain the "Average Daily Consumption."

Divide "Monthly Total Gallons Pumped" by the days in the month.

Add the "Total Gallons Pumped."

### Obtain the "Daily Average for the Year."

Add the "Daily Consumption" and divide by 12.

### Obtain the "Per Capita Consumption."

Divide the "Daily Consumption" by the number of consumers for the month, which factor is obtained from the records.

Cross-add "Pumping" and "Banking," for monthly total. Then add the columns—"Pumping," "Banking," "Total," and prove the sum of "Pumping" and "Banking" against the total.

### Obtain the "Monthly Duty Average."

Add the "Duty per 100 Pounds of Coal" and divide by 12.

### Obtain the "Gallons Pumped Per Pound of Coal."

Divide the "Total Gallons Pumped," 348,731,100, in the first item, by the "Coal Used for Pumping," 1,108,334 lbs.

### Obtain the "Monthly Average Gallons per Pound."

Add the "Gallons per Pound" and divide by 12.

Back of this report is an accumulation of detailed data from day to day. The Comptometer furnishes every result with **Absolute Proof**. The relief afforded is inestimable.

## MONTHLY FUEL REPORT

The quantity of coal on hand is taken from actual measurement, while the other data is on hand from the records.

(See form illustrated on next page.) "Monthly Report of Fuel Consumption by Measurement."

### Results Wanted:

Coal on hand.  
 Coal burned.  
 Percent of coal per million gallons pumped one foot high.  
 Coal on hand August 1st.

### METHOD

Add on the right side of Keyboard  
     The coal on hand,  
     The coal received.  
 Equals the coal available,      5,778,705 lbs.  
 Deduct the coal on hand      928,600 lbs.  
 \_\_\_\_\_  
 Equals Total Coal Burned      4,850,105 lbs.  
 The Foot Gallons pumped for the period are abstracted from another report.

Divide the Total Coal Burned, 4,850,105 lbs., by the Million Foot Gallons pumped during the period, 417,293.-78 = 11.6 pounds of coal per million gallons pumped one foot high.

As there will be but three figures in the answer, use only the first four figures of the divisor, i. e., 4173.

### Coal on Hand August 1st:

Add on the right of Keyboard the quantities of coal on hand July 1st,      497,655 lbs.  
 Coal received in July,      2,928,750 lbs.  
 \_\_\_\_\_  
 And subtract from this the      3,426,405 lbs.  
 amount burned in July,      2,835,180 lbs.  
 \_\_\_\_\_  
    591,225 lbs.

### Coal Burned to August 22d:

Add in the Comptometer the total coal burned for the period,      4,850,105 lbs.  
 Subtract coal burned in July,      2,835,180 lbs.  
 \_\_\_\_\_  
 Equals amount burned in Aug.      2,014,925 lbs.  
 The Comptometer produces accurate results and proofs in a manner that is very gratifying.



# Monthly Report of Fuel Consumption by Measurement

## DIVISION OF OPERATION OF PUMPING STATIONS

Chicago Ave. PUMPING STATION FOR July 1913.

Coal on hand	<u>July</u>	1, 1913	<u>497,655 #</u>
Coal received in	<u>July</u>	1913	<u>2,928,750 #</u>
Coal received in	<u>Aug. 8/1 - 8/22</u>	1913	<u>2,352,300 #</u>
Coal received in		1911,	
Coal received in		1911,	
Total coal available	<u>July</u>	1, 1913 to <u>Aug. 22<sup>nd</sup></u>	<u>1913 5,778,705 #</u>
Coal on hand	<u>Aug. 22<sup>nd</sup></u>	1913 3 P.M.	<u>928,600 #</u>
Total coal burned	<u>July 1<sup>st</sup></u>	1913 to <u>Aug. 22<sup>nd</sup></u>	<u>1913 4,850,105 #</u>
	<u>July</u>	Pumpage x Head, 1913	<u>244,411.731 F. G.</u>
	<u>Aug. 8/1 - 8/22</u>	" x " 1913	<u>172,882.052 "</u>
	"	x " 191	
	"	x " 191	
Total Pumpage x Head	<u>July</u>	1, 1913 to <u>Aug. 22</u>	<u>1913 417,293.783</u>
Pounds of coal per million gallons pumped one foot high			<u>11.6 #</u>
Coal burned in	<u>July</u>	1913	<u>2,835,180 #</u>
Coal burned in		191	
Coal burned in	<u>Aug. 8/1 - 8/22</u>	191	<u>2,014,925 #</u>
Coal burned		191 to	191
Total coal on hand	<u>Aug. 1<sup>st</sup></u>	1913	<u>591,225 #</u>

The coal in bin measures 40' 8" x 5' x 9'  
and 125' x 7' 6" x 16'  
and weighs approximately 51½ lbs. per cu. ft.  
Multiply, 3 Factor Way, for cubic contents of each bin =  
1830 and 16200, or 18030 cu. ft.  
Add the bin contents and multiply by the weight per cu. ft.,  
51.5 = 928,545 (read as 928,600 lbs.)



## PAPER MILLS

The principal phases of work to which the Comptometer is especially adapted are —

Purchase Invoices  
Figuring and Proving Outgoing Bills  
Costs  
Statistics  
Inventories  
Stock Cards  
Payrolls  
General Bookkeeping, etc.

## Purchase Invoices:

1. **Raw Materials** consist of a variety of articles, such as Sulphur, Spruce, Clay, Alum, Colors, Ground Balsam, Pulp, etc.

## EXAMPLE:

76465 lbs. Ground Spruce @ \$2.15 Cwt. = \$1644.00

Hold the rate for Key Factor at the right of Comptometer, and multiply the weight, 76465 = \$1644.00

2. Proving Mill Supply Invoices, such as for Pipe Fittings, Belting, Hose, etc., is one of the important factors in the Purchasing Department.

## Proving the Supply Bill:

Accumulate the Gross Extension for each of the items, e. g.—

Hold the price of pipe, \$.755, over the Fixed Decimal, for Key Factor, and multiply the feet, 164.5833 = \$124.26039. Leave the result in the Register and multiply the next quantity, 214.916 feet, by the price \$.95 = total of \$328.43. Then figure the net as follows:

## Method 1.

Multiply, 3-Factor Way, by the net of the first discount, 35%, = \$114.95.

If using a 12-column Comptometer, leave this amount in the

HADLEY PAPER COMPANY				To		Saratoga Plumbing & Heating Co. Dr.	
1-17-1910							
				Gross Extension	Net Extension	Total	
164'	7"	W.I. Pipe @ \$.75 <sup>1</sup> / <sub>2</sub>	per foot	124.26			
214'	11"	" " " .95	" "	204.17			
Less 65-5%				328.43	109.20		
324'	5"	1 <sup>1</sup> / <sub>2</sub> " W.I. Pipe @ \$.27	foot	87.59			
278'	6"	1 <sup>1</sup> / <sub>2</sub> " " " .22 <sup>1</sup> / <sub>2</sub>	" "	62.66			
Less 55-2 <sup>1</sup> / <sub>2</sub> %				150.25	65.92		
6	-	3" W.I. Couplings @ \$.80	each	4.80			
4	-	3 <sup>1</sup> / <sub>2</sub> " " " 1.05	" "	4.20			
2	-	3 <sup>1</sup> / <sub>2</sub> " x 3" Reducers	" 1.00	2.00			
8	-	3 <sup>1</sup> / <sub>2</sub> " x 3" Tees	" 1.75	14.00			
4	-	3" x 1 <sup>1</sup> / <sub>2</sub> " x 1 <sup>1</sup> / <sub>2</sub> "	" " 1.25	5.00			
2	-	3" x 1 <sup>1</sup> / <sub>2</sub> " Crosses	" 2.20	4.40			
16	-	3" Elbows	" .75	12.00			
4	-	3 <sup>1</sup> / <sub>2</sub> " " " 1.05	" "	4.20			
27	-	1 <sup>1</sup> / <sub>2</sub> " " " .20	" "	5.40			
35	-	1 <sup>1</sup> / <sub>2</sub> " " " .16	" "	5.60			
Less 70-10-5%				61.60	15.80		
146	1/8"	D.K. Leather Belting @ 2.65	foot	386.90			
Less 50-5%					183.78		
						874.70	

Register and again multiply, 3-Factor Way, by the net of 5%, which is 95%, = \$109.20.

If using a smaller size of Comptometer, clear the Register each time and multiply by the net of the discounts from the right of the keyboard.

## Method 2.

Get the net of the Chain Discount, .3325, from the "Comptometer Chain Discount Table," and multiply the gross extension by same.

Figure the other items in the same manner; then add several net extensions for the total of invoice.

## OUTGOING BILLS

Print and Wrapping paper is usually sold by the Cwt. or Ton. Writing or Bond Paper, by the Ream and Quire. The standard quantity is 500 sheets to the ream, 25 sheets to the quire. Thus a quire is one-twentieth of a ream and is expressed as such.

J. W. Harris Paper Company,				To	Paper Mills Corporation, Dr.	
<u>Oct. 10, 1913.</u>						
					Net Extension	Total
27250 lbs.	Print Paper at	\$37.50	Net Ton		\$510.94	
1540 "	Wrapping " "	3.75	per Cwt.		57.75	
46 Reams	" " "	3.95	" Ream		181.70	
2-8/20 "	Special Writing " "	11.60	" "		27.84	
35 "	25 x 38-80# Book " "	.08-3/4¢	lb.		<u>245.00</u>	
						\$1023.23

### EXAMPLE:

1. 27250 lbs. Print @ \$37.50 Net Ton = \$510.94.

### COMPTOMETER WORK

Hold one-half the rate for Key Factor over Fixed Decimal (\$18.75) and multiply the weight, 27.250 = \$510.94.

Pointing off three places for the thousand pounds. Split the Key Factor, using first 18, and multiplying towards the right. Then shift to the 75 keys and multiply back towards the left.

1540 lbs. Wrapping Paper @ \$3.75 Cwt. = \$57.75  
 46  $\frac{7}{10}$  Reams Writing Paper @ 3.95 Ream = 183.08

Hold the rate for Key Factor over the Fixed Decimal and multiply the reams and decimal of a ream; i. e.,  $46.35 \times \$3.95 = \$183.08$ .

One-twentieth of a ream is .05. Therefore, to determine the decimal of a ream, multiply the number of twentieths by .05, as,  $7 \times .05 = .35$ .

## PAPER MILL DAILY RECORDS

The Beater Room Report shown below is one of several reports that are made out daily.

KIMBERLY-CLARK CO.—Neenah Mill BEATER ROOM															
Mill No. Use a separate Sheet for each Mill Number.														Machine No. Grade and Color	
No. of Beaters	Pounds BROKEN	Paper Stock Used		Pulp Used						Pounds Soda Pulp	Pounds Clay	Pounds Alum	Pounds Size		
		Lbs. Shavings	Cans No. 1 Books	Bbls.	Kind	Bbls.	Kind	Bbls.	Kind					Ounces	Kind
2	416			26	Spruce			58	Blue	216	146	137	560	156	Blue
2	485			29				61		224	145	162	568	142	"
2	465			28				60		215	144	175	571	167	"
3	516			31				68		265	156	190	591	194	"
1	295			21				28		190	112	126	463	78	"
2	316			24				37		198	130	137	490	64	"
12	2493			159				312		1308	838	927	3243	801	

## Comptometer Work.

Add the various columns for the daily totals "Pounds Broken" and of each stock used, i. e.—

416, 485, etc. = 2493 "Pounds Broken."

26, 29, 28, etc., = 159 bbls. "Pulp."

Treat in the same manner the columns of Pulp Bundles, "Pounds Soda Pulp," "Pounds Clay," "Pounds Alum," "Pounds Size" and "Ounces."

## COSTS

The Cost Department figures the cost of each mill order, which involves a number of Percentages, Costs per Ton, etc.

When a Mill Order is to be made up, samples of wet Sulphite, Ground Spruce, etc., are put in a drier and the water is taken out to get the Net Weight. The percentage of the Wet Weight against the Net Weight is then figured, which will be used as a basis for figuring the net weight in the Mill Run.

Determining Percentages of Dry Weight to Wet Stock.

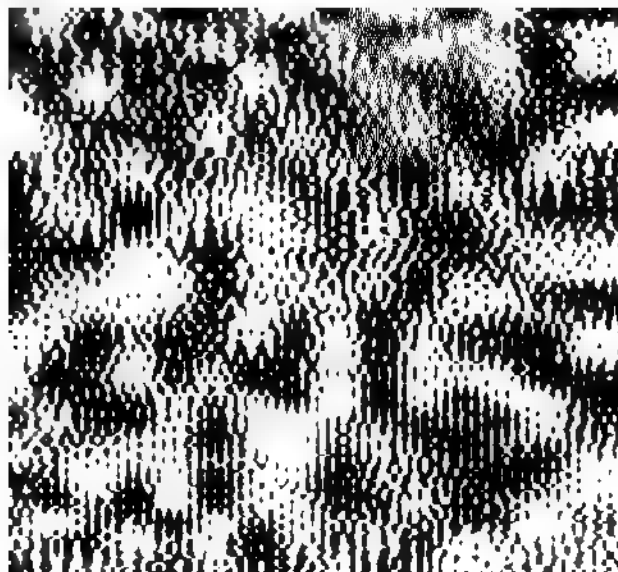
i. e., 55½ lbs. of wet stock put in the drier, and after the drying process weighs 22 lbs.

### What is the Per Cent of Dry Weight?

Add the Dry Weight, 22 lbs. in the Comptometer at the left and divide by the Wet Weight, 55.5 lbs., = 39.63%.

Figure the per cent for each dry weight in the same manner.

The Cost Sheet exhibits all the ingredients contained in the Mill Run.



The 12 or 10-column Comptometers are much to be preferred on this class of work.

## MILL RUN COST SHEET

22-6-111

1000	Wet Spr	38.14	1077	205	222.94
1050	Spruce Grd	4142	4349	120	52.19
	Wet Spruce Grd	87.2	2800	180	441.00
140	Clay	20.14	2800	80	22.40
70	Slip	1	560	250	14.00
44	Alum	23.46	1012	142	14.37
245	g. Blue S. Blue	15.75	40	4	1.25
	Blue color	35	39	13	65
	Food color	175	76	13	65
Total direct material cost		Gross			1008.27
Less Cr account waste			787	200	15.74
Total direct material cost		Net			
205941 Cost Per Cwt					992.63
No. of Beakers dropped			35		
Finished paper per beaker			1093		
Machine weight made			40000		
Weight finished			3824		
Time run on machine		Hours	34		
On Finished Weight Per Cwt					
OVERHEAD: (Including Gen. Exp. & Supt. chgs.)			7.41		540.00
Special			0.06		22.00
TOTAL COST			4.07		1557.63
Net selling price			5.096		1950.00
Profit			1.025		392.37
Remarks					
Mach. wt. made Per beaker			1176		
Wt. finished			1125		

## PAPER MILL COST SHEET—Continued

**Working up the Cost Data:****The Net Weight and Cost of Each Ingredient:****Take Bleached Sulphite—**

Hold the Wet Weight, 17500 for Key Factor and multiply the percent  $3963 = 6935$  lbs.

Leave the weight in the register and multiply by the price, Three Factor Way, = \$208.05.

Continue in the same manner for each item.

Extend the waste having a value by price, 787lb @ \$2.00 Cwt. = \$15.74.

Add the Cost Items, \$208.05, \$222.94, etc., = \$1008.37.

Then subtract the amount of waste, \$15.74 = Net Cost, \$992.63.

**Statistical Work:**

Figuring Material Cost per Cwt. of Finished Paper

Figuring Overhead Expenses per Cwt. of Finished Paper

Figuring Special per Cwt. of Finished Paper

Figuring Net Selling Price per Cwt. of Finished Paper

Figuring Profit per Cwt. of Finished Paper

These cost items are all based on the Finished Weight, and, therefore, must be divided by same, viz., 38264. This being a constant divisor, get its reciprocal and multiply same by each corresponding amount.

i. e., Add 1 in the Comptometer at the left and divide by 38264 = 26134, the reciprocal.

Then multiply 992.63 by 26134 = \$2.594, cost per Cwt. of Stock.

Then multiply 540.00 by 26134 = 1.411 cost per Cwt. of Overh'd.

Then multiply 25.00 by 26134 = .065 cost per Cwt. of Special.

4.070

Add the cost items for total cost per Cwt. = 4.070.

To Prove, multiply the Total Cost, \$1557.63 by the reciprocal, 26134 = 4.071.

**Finished Weight per Beater:**

Divide the finished weight by the number of Beaters, 35 = 1093 lbs. per Beater.

i. e., Add 38264 in the Comptometer at the left and divide by 35 = 1093 lbs. per Beater.

Figure the Net Selling Price and Profit per Cwt. in same manner as above.

**Production:**

Machine Weight per Hour.

Finished Weight per Hour.

Add each weight in the Comptometer and divide by the hours, i. e., 40,000 divided by 34 = 1176, etc.

One of these sheets is made out for each mill run and worked up daily.

## STATISTICAL WORK

### Statistics:

The determining of the Average Monthly Cost of each material used and the Labor Average Costs involve many Comptometer operations. The speed and accuracy of the Comptometer makes it indispensable.

### Material and Labor Costs:

U. S. PAPER MILLS CO.									
UNIT COSTS AND PERCENTAGES July, 1913.									
213 Tons			Cost Per Ton	Ratio to Mat'l Total		Ratio to Grand Total			
Wood	1765	40	8 289	36	37	24	11		
Fuel	375	60	1 763	7	74	5	13		
Felts	95	70	449	1	97	1	31		

2365 40 11 11

Wires	87	45		412	1	80	1	19	
Screens	107	65		505	2	22	1	47	
Oils	56	40		265	1	16		77	
	4853	60	22	79					
LABOR					Ratio to Labor Total				
Wood Yard	390	65	1	834	15	83	5	34	
Wood Room	485	70	2	290	19	69	6	63	
Grinders	765	40	3	593	31	01	10	45	
Truckers	560	70	2	632	22	72	7	66	
Deckers	265	70	1	247	10	76	3	63	
Total Labor Cost	2468	15	11	59					
GRAND TOTAL	\$7321	75	23	27					

### Comptometer Work:

Add the items of Material Cost,  
 $\$1765.40, \$375.60, \text{etc.} = \$4853.60$   
 Then the items of Labor Cost  $= 2468.15$

And then the Grand Total  $= \$7321.75$

The production is 213 Tons.

What is the Cost per Ton?

Divide each item of cost by the Tons Produced.

$\$1765.40 \div 213, 375.60 \div 213, \text{etc.}$

As the Divisor is a constant, get the reciprocal; i. e.,  
 $1 \div 213 = 46948$ . Then hold the reciprocal at the left of  
 Keyboard for Key Factor and multiply each expense item  
 respectively, splitting same, using first 469, then 48.

$\$1765.40 \times 46948 = \$8.289$

$375.60 \times 46948 = 1.763, \text{etc.}$

See "Reciprocal Work" for Pointing Off.

What are the Ratios of each to the Sub-Totals and  
 Grand Total?

Work up in the same manner; i. e., get reciprocals of  
 Material Cost,  $\$4853.60 = 20603$ ; Labor Cost,  $\$2468.15 =$   
 $40516$ ; Grand Total,  $\$7321.75 = 13658$ , and then multiply  
 the items of material cost and labor cost,

i. e.,  $1765.40 \times 20603 = 36.37$

$375.60 \times 20603 = 7.74$

etc.

$390.65 \times 40516 = 15.83$

$485.70 \times 40516 = 19.68$

etc.

$1765.40 \times 13658 = 24.11$

$375.60 \times 13658 = 5.13$

etc.



## INVENTORIES

Paper Mills usually take physical inventories monthly or quarterly. See **Comptometer Work** below.

CALLED BY UB SHEET EXTENDED BY UN  
 ENTERED BY HJ STRIP EXTENDED BY JK

11-1914

EXTENSIONS

1429820

**Book Paper:**

Hold price \$3.15, over Fixed Decimal, for Key Factor and multiply the reams, 317.45 = \$999.97.

**Final:**

As this is priced by the ton, hold one-half of the price, \$1.40, over the Fixed Decimal, for Key Factor, and multiply by the pounds, with three places pointed off, 147.215 = \$206.15.

**Print Paper:**

Hold the price, \$4.65, for Key Factor and multiply the Cwt., 57.25, over the Fixed Decimal, = \$266.21.

**Payrolls:****STOREKEEPER**

The Time Books are added and proved; Extensions made and verified; Payrolls analyzed, etc. (See "Payroll".) For—"Ledger Work," "Cash Books," "Journals," etc., see "Bookkeeping."

# WHOLESALE PAPER AND TWINE

## FOREIGN INVOICE

FIGURED — STERLING

<u>Union Paper and Twine Co.</u> DR. .					Date <u>June 6. 1912</u>		
TO <u>EKMAN and CO.</u>					Sweden.		
Rolls	Quality	Kilos	Tons	CWT.	Qu.	Lbs.	
100	White Sulphite Paper	410	(Gross Ton)				2.20474 lbs per Kilo.
121		783					
220		1927					
178		1958					
250		3 225					
869		8 303	8	3	1	22	
<u>NET F.O.B.</u>		£	5	d			
<u>Sweden</u>		12	15	8	Per G.T.		
		104	9	5			
<u>Consul Fee</u>			10	6			
		104	19	11			
@ 48665 Exch. = \$510.74 on June 6							
Rec'd. July 7. @ Rate 4.8725 = 511.37							

PRICE IS BY G.T. — 2240 Lbs.

1 KILO = 2.20474 "

FIRST FIND 1 KILO IN G.T.

$\frac{2.20474}{2240} = .00098426$

MUL. KILOS BY DECIMAL OF G.T.

$8303 \times .00098426 = 8.1723$  -

REDUCE PRICE TO PENCE

MUL. G.T BY -

REDUCE PENCE TO £ S d

" STERLING - CURRENCY AT RATED EXCH.

## PRINTING HOUSES AND BINDERIES

The Comptometer is a great aid and time saver in handling and figuring the work in Printing Houses and Binderies. They have all the usual bookkeeping and accounting work, on which the Comptometer excels; also, figure work peculiar to their line.

The principal Comptometer uses are the following:

### **Estimate Sheets:**

- Determining Number of Reams.
- Determining Pounds of Paper.
- Determining Pounds in Cover Stock, Composition, etc.

### **Footing and Extending the Time by the Rates on —**

- Compositors' Tickets,
- Job Press Reports,
- Bindery Time Tickets,
- Cylinder Press Reports,
- Invoices,
- Department Credits.

### **Footing of:**

- Composition Hours,
- Press Hours,
- Number of Impressions.

### **Adding:**

- Sales Books,
- Cash Books,
- Ledgers, etc.,
- Proving Daily Postings,
- Balancing Ledger Accounts,
- Trial Balances.

### **Payrolls:**

- Extending and Footing,
- Determining Currency Denominations.

### **Invoices:**

- Extending and Proving.

### **Inventories:**

- Stock Ledger, etc.

THE COMPTOMETER SIMPLIFIES COST WORK

## ESTIMATE SHEETS

The estimate sheet illustrated herewith represents an estimate on 8,000 books, each 216 pages and cover. Outside front and back covers two colors; sewed book, cover glued on; trimmed book size, 6 x 9"; printed on paper 38 x 50", weighing 160 lbs. per ream and costing 8½¢ per lb.

Book paper is put up in reams of 500 sheets each. The number of pages for each form and the size of sheet required is usually determined by inspection. In this case, the job will be run in six 32-page forms, comprising 192 pages and one 16 and 8-page "work and turn" form, wasting 8 pages blank stock.

### PAPER STOCK

Paper stock will be required as follows:

With the larger forms 32 pages are printed on each side of the sheets; therefore, one sheet will print 64 pages and three sheets will be required to print 192 pages.

On the smaller form one sheet will print 48 pages, or two sheets of the remaining 24 pages; hence, one-half sheet will be required for 24 pages, or a total of 3½ sheets per book.

### COMPTOMETER METHOD

#### Figuring the Time Cost:

Use the Fixed Decimal and multiply the **rates** by the hours, jotting down each extension. There are 6 forms requiring 30 hours each, hence, 180 hours.

$$180 \times \$1.80 = \$324.00$$

$$22 \times 1.60 = 35.20$$

etc.

Then add the labor items = \$409.60.

Extend the ink in the same manner, adding 10% for handling, = \$19.80

#### How Many Sheets Required?

Three and one-half sheets of 160 lb. paper are required for each book; therefore, hold 3.5 at right of Keyboard and multiply the number of books, 8,000, = 28,000 Sheets.

#### Add 3% for Waste.

Leave the 28,000 in the register and multiply by 103%, 3 Factor Way, = 28,840 Sheets.

#### How Many Pounds of Paper?

Leave the 28,840 sheets in the register. Multiply 160 by .002 (reciprocal for 500), = .320. Multiply the sheets 28,840, 3 Factor Way, by .320, = 9228.8, which is considered as 9,230 lbs.

#### What is Paper Cost?

Add 1.2 lbs. to the weight of paper so that the register shows the 9,230. Then multiply by the price, \$.085, 3 Factor Way, = \$784.55, Paper Cost.

The 10% to be added is seen at a glance, so jot down the amount, \$78.45.

(Continued on following page.)

44-38861-104

COMPTONETER WAY  
Accumulated to Depart-  
ment Totals in One  
Operation.

550		
40960	1980	
1000		
42510	89666	
5314	91646	
20800	4582	
\$96228	\$96228	
164852		

## ESTIMATE SHEETS—Continued

### COVER STOCK

Figure in the same manner.

Size required is found to be 20 x 25", which cuts two covers the 20" and four the 25" way, or four sets of covers from a sheet. Add the number of books, 8,000, in the Comptometer and divide by the number of covers cut from a sheet, (4), = 2000 sheets of cover stock.

The covers to be two-color work will be run through the press twice; so add 6% for spoilage.

### How Many Pounds of Cover Stock?

Hold 1.06% (actual stock plus per cent spoilage) for Key Factor at right of Keyboard or over the Fixed Decimal and multiply the number of sheets, 2,000, = 2,120 sheets required.

This cover stock weighs 80 lbs. to the ream. Multiply the weight per ream by .002 (the same as dividing by 500), = .160. Leave this in the register and multiply the gross sheets, 2,120, 3 Factor Way, = 339.2, which is entered as 340 lbs.

### Cost of Cover Stock:

Add .8 to the lbs. to make the register show 340 lbs., and multiply by the price, 9c, 3 Factor Way, = \$30.60.

Jot down this amount, also 10% of same, \$3.06, which is seen at a glance.

### Total Stock Cost:

Add the items of paper stock cost, \$784.55, \$78.45, etc., = \$896.66. Jot down this amount and then continue and add to it the other items of stock cost, \$18.00, \$1.80 = \$916.46. Leave this amount in the register and multiply by 5%, 3 Factor Way, = \$45.82. Add to this amount the stock cost, \$916.46, = \$962.28, the amount estimated for paper stock.

Now add the labor items, \$5.50, \$324.00, etc., = \$425.10. Leave this in the register and add 12½%, i. e., multiply by .125, 3 Factor Way, = \$53.14. Clear and multiply the quantity of books by the binding estimate, \$26.00 per M, = \$208.00. Now add the several departmental cost items, \$425.10, \$53.14, etc., = \$1,648.52, which, roughly speaking, would be the amount of the estimate.

### Shorter Comptometer Method:

Jot down the amount of labor on the "Lock-Up," \$5.50.

Now extend accumulatively the various hours by rates, i. e.,

180 hours at	\$1.80
22 hours at	1.60
18 hours at	1.60
24 hours at	.90

Gives a total of \$409.60.

Clear, and figure the ink, 60 lbs. at 30c, and add to it 10%, = \$19.80, cost of ink.

Now figure the weight of paper as before, equals 9,230 lbs. Then figure the weight of the cover stock, which equals 340 lbs. Accumulate the stock cost, i. e.,

9,230 lbs. at 8½c

340 lbs. at 9c = \$815.15

Add 10%, which is seen at a glance to be \$81.51, = \$896.66, Total Stock Cost.

Leave the cost of paper stock, \$896.66, in the register and add to it the other items of stock cost = \$916.46. Leaving this in the register, increase it by 5%, using the Fixed Decimal method.

Now add and figure the labor cost in the same manner, excepting that it is increased by 12½% and add the several items for total of estimate.

## STANDARD SIZES AND EQUIVALENT WEIGHTS OF PAPER

**TABLE OF EQUIVALENT WEIGHTS PER REAM OF BOOK PAPER**

UNIT 1000 sq. in. surface area of a ream weighing 1 pound.	20x25 500 sq. in.	22x28 616 sq. in.	24x36 864 sq. in.	25x38 950 sq. in.	28x42 1176 sq. in.	32x44 1408 sq. in.
	500 sheets to the ream					
	LBS.	LBS.	LBS.	LBS.	LBS.	LBS.
25	12	15	22	24	29	39
30	15	18	26	29	35	42
35	17	22	30	33	41	49
35.5	18	22	31	34	42	50
40	20	25	35	38	47	56
42.1	21	26	36	40	49	59
42.6	21	27	37	41	50	60
45	22	28	39	43	53	63
46.1	23	28	40	44	54	65
50	25	30	43	47	59	70
51	26	31	44	48	60	72
52.6	27	33	46	50	62	75
55	27	34	47	52	65	77
56.8	28	35	49	54	67	80
57.8	29	36	50	55	68	82
60.3	30	37	52	57	70	85
63.1	31	39	54	60	74	89
65	32	40	56	62	76	92
68	34	42	59	65	80	96
70	35	43	60	66	82	99
71	36	44	61	67	83	100
73	37	45	64	70	87	104
75	37	46	65	71	88	106
80	40	50	70	76	94	113
84.2	42	52	73	80	99	118
85	42	52	73	81	100	120
90	45	55	78	85	106	127
92.5	46	57	80	88	109	131
94.6	47	59	82	90	112	134
100	50	62	86	95	118	140
102	51	63	88	97	120	144
105.2	52	65	91	100	123	148
110	55	68	95	105	130	155
126.3	63	78	109	120	148	177

By permission of R. R. Donnelley & Sons Co.

The Standard or Mill sizes of Book Papers and their equivalent weights are shown on the Tables below.

**STANDARD WEIGHTS OF PAPER**

24 x 36	25 x 38	28 x 42	32 x 44
20	30	40	45
25	35	45	50
30	40	50	60
35	45	60	70
40	50	70	80
50	60	80	100
60	70	100	120
	80	120	140
	100		

Many times the paper specified is based on a certain size and weight, but another size of corresponding weight will be used to avoid a large waste.

### FIGURING WEIGHT OF SPECIAL SIZES

#### EXAMPLE:

A specification for a large run calls for paper on a basis of 25×38—60 lbs. It is found that 30×48 will eliminate a large waste.

What weight in the 30×48 will be equivalent to 25×38—60 lbs.?

#### METHOD

Multiply the sq. in. surface area of the proposed paper by the unit of that used for a basis = weight per ream of proposed size.

Hold 48 for Key Factor on right of Keyboard and multiply 30 = 1440 square inches in the 30" x 48" paper.

Leave this in the register and multiply by the weight of the base, as found in the table opposite, (25×38—60 lbs.), 63.1 pointing off four places = 90.86 lbs. per ream.

### USE OF THE EQUIVALENT TABLE

What weight of 32×44 paper is equivalent to 25×38—80 lbs.?

#### METHOD

Refer to the accompanying table of equivalents. Find the line containing the 25×38—80 lb. paper and on this line, under 32×44 size read the equivalent weight, 118 lbs. per ream.

Under **Standard Weights**, 32×44, you find 120 lb. paper is the nearest stock size, which would be used unless a mill order is made for a special size.

## COST STATISTICS IN PRINTING HOUSES

The Standard Cost Finding System, as devised by the American Printers' Cost Commission and adopted by the International Cost Congress and the United Typothetae of America, embraces the following recommended forms:

"Individual Job Record;" "Daily Time Tickets" for Composing Room, Press Room and Bindery; "Department Payroll," "Monthly Record of Department Chargeable and Non-Chargeable Hours" (Composing Room and Bindery); "Monthly Record of Chargeable and Non-Chargeable Hours" (Press Room), and "Statement of Cost of Production for Month."

There is a splendid field for the Comptometer in making the extensions, footings and pro-rata divisions on these forms.

The basis of product is the "Sold Hour" in each department, and the labor cost in each department is recorded in hours, the rates being used only on the Payroll. The reason for this is that, even in Union Shops, there are variations in pay for the same classes of work. The actual cost for running the same job through the house at different times might show a wide variation, while this is almost entirely avoided by using an **average labor cost** for each class of work. To secure this average labor cost for each class of work involves considerable statistical cost work, on which the **Comptometer excels**.

In figuring paper stock  $12\frac{1}{2}\%$  is added to the original cost as a burden charge. The time is entered in hours and tenths of an hour; i. e., six minutes is used as the minimum time unit.

### INDIVIDUAL JOB RECORD

We illustrate herewith an "Individual Job Record," as recommended by the Commission.

#### Working up Job Record with the Comptometer:

The various items of material and labor are entered on the Job Record under their respective headings from day to day from the time tickets until the job is completed. In some cases the time tickets are kept together until the job is completed, when one entry is made at a time in each department.

#### Figuring the Cost and Selling Price:

The job illustrated, is to be figured as day work, plus 25% profit. Hold the rate per lb., \$.0625, for Key Factor, over the Fixed Decimal and multiply the weight, 350 lbs., = \$21.87. The original paper cost is now in the register in Fixed Decimal position. Add  $12\frac{1}{2}\%$  to it for burden, i. e., multiply \$21.87 by .125, over the Fixed Decimal, = \$24.60, the cost of paper.

We now have to increase this amount by 25% for the selling price; therefore, leave it in the register in fixed decimal position. Hold .25 for Key Factor over the Fixed Decimal and multiply \$24.60, as before, = \$30.75, the selling price.

Figure Cover Stock in same manner. To get the weight, merely multiply  $2-18/20$ , or 2.9, by 55 lbs., = 159.5 lbs.

#### Figuring the Labor Items:

The Labor Cost is figured on the basis of flat rate per hour. This flat rate is determined by accumulating the cost of labor and burden charges for the month and dividing the total by the number of hours worked in the department. This is the average rate. This flat rate usually governs the work for the following month. A new flat rate is thus obtained every month.

After the first month of the year, the total items and total burden charges to date are included in making up the department rates per hour.

(Continued on following page.)



# INDIVIDUAL JOB RECORD

PRINTING SYSTEM. FORM 2. DESIGNED BY AMERICAN

STOCK		COMPOSING		PRESS WORK		CYLINDER		QUANTITY		DATE		PRICE		TOTAL	
② 93/44#															
(12 1/2% is added for handling)															
ENGRAVINGS															
ELECTROS															
LABOR ITEMS															
HAND 13.1 HRS. • 1.31		17	16	21	43										
" OVERTIME " "															
ALTERATIONS 2.8 - - 1.31		3	67	4	59										
" OVERTIME " "															
MACHINE 7.7 - - 1.70		13	09	16	36										
" OVERTIME " "															
CYLINDER 8 - - 1.67		13	36	16	70										
" " " "															
JOBBERS 14.9 - - 58		10	13	12	66										
UNIVERSAL " " "															
" " " "															
INK 5 LBS. - 60		3	00	3	75										

CYLINDER		QUANTITY		DATE		PRICE		TOTAL	
3	1/2	203	1	1	1/2	301	875	37	
		203	2	1	1/2	301	1850	58	
		204	2575	2	5	1/2	303	5025	
3	1/2	204	3550	2	5	1/2	301	101	
						1/2	301	5040	
						1/2	301	61	

BINDERY - PIECE WORK		DATE		QUANTITY		PRICE		TOTAL	
EMPLOYEE	DATE	QUANTITY	PRICE	TOTAL	DATE	QUANTITY	PRICE	TOTAL	

MACHINE COMPOSITION		JOB PRESSWORK		DATE		QUANTITY		PRICE		TOTAL	
EMPLOYEE	DATE	QUANTITY	PRICE	TOTAL	DATE	QUANTITY	PRICE	TOTAL			

BINDERY - MACHINE WORK		DATE		QUANTITY		PRICE		TOTAL	
EMPLOYEE	DATE	QUANTITY	PRICE	TOTAL	DATE	QUANTITY	PRICE	TOTAL	

## INDIVIDUAL JOB RECORD

### FIGURING THE LABOR ITEMS—Continued

Add the time consumed in each department.

#### For Example:

**Hand Composition** — 1.5 hours, .5 hours, 5.3 hours, etc. = 13.1 hours Hand Composition (less alterations).

Leave the hours in the register and multiply by the price per hour, 1.31, 3 Factor Way = \$17.16, Cost. This amount must now be increased by 25%. Leave the amount in the register; hold .25 over the present decimal and multiply 17.16, using the Fixed Decimal Method. This will add the 25% of 17.16 to itself.

Or—

With the 17.16 in the register, multiply, 3 Factor Way, by 125%.

Continue in the same manner with the Labor and other cost items from each department.

### TOTAL COST AND SELLING PRICE

Add the Selling Prices, \$30.75, \$21.87, etc. = \$155.47.  
Add the Cost Items, \$24.60, \$17.50, etc. = \$124.39.

#### To Prove the Selling Prices:

Leave the Total Cost, \$124.39, in the register and increase by 25%, using either of the above methods = \$155.47.

An easier method is to use the present decimal as Fixed Decimal and multiply \$124.39 by 25%.

The completion of this Individual Job Record, therefore, shows that the work which was contracted for at a contract price of \$160.00 actually figured \$155.47, including the regular 25% profit.

### STATISTICAL VALUE OF FORM

This form is kept in a loose sheet binder, the successive leaves being consecutively numbered. It is from these leaves that each job as it comes in, and is ready for entry, is given its proper job number, the data from the Job Ticket is copied to the reverse side of this form. Incidentally, as the time reports come in for entry each day, the act of entering them serves as a job tracer and readily shows in which department any given order can be located when desired.

The binder containing the sheets of this form will be the most referred to of any of the system, as this contains the gist of that which the cost system aims to disclose, to-wit: Cost on individual jobs. A close scrutiny of this form will show where and how records are kept, the time taken on each operation of the job, together with its labor cost, as well as the material used on the job. It will show the summing up of the costs of labor and material summarized, the cost of the job and the selling price.

If the system is properly kept and all charges properly made, then the sum of all the profits shown by these sheets should be the net profit for the period in which it is taken.

When the job is completed, the cost computed and the job charged to the customer, then the sheet should be taken out of the binder and filed into a transfer, or if desired it can be enclosed in the Job Ticket Envelope. By removing the completed sheets from day to day, as work is finished, there are left only the live or uncharged jobs which are still in process, making practically a going inventory of goods in process.

Standard Uniform Cost Finding System Form 25. Revised 4. Machine Printers' Cost Computation

### BINDERY DAILY TIME TICKET

EMPLOYEE Lee, Y. C. CLOCK NO. 6 DATE Nov 15 1917

"TIME OF WORK" COLUMN MUST BE FILLED IN, UNDER WORKING LETTERS ON BASIS OF QUOTAS. THIS SEPARATE TICKET FOR QUOTING AND TIME TICKET STAMPED "OVERSEEN" BY PERSON

JOB NUMBER	FOR WHICH	QUOTAS IN QUANTITY	TIME OF WORK	QUANTITY	TIME OF WORK	TIME OF WORK	TIME OF WORK	TIME OF WORK	TIME OF WORK
15850	Allegretto Co		301	275		8:00	11:45	3:15	
16907	Morgan Co								

---

Standard Uniform Cost Finding System Form 26. Revised 4. Machine Printers' Cost Computation

### COMPOSITOR'S DAILY TIME TICKET

EMPLOYEE Y. C. Lee CLOCK NO. 71 DATE December 12 1917

"TIME OF WORK" COLUMN MUST BE FILLED IN, UNDER WORKING LETTERS ON BASIS OF QUOTAS. THIS SEPARATE TICKET FOR QUOTING AND TIME TICKET STAMPED "OVERSEEN" BY PERSON

JOB NUMBER	FOR WHICH	QUOTAS IN QUANTITY	TIME OF WORK	QUANTITY	TIME OF WORK	TIME OF WORK	TIME OF WORK	TIME OF WORK	TIME OF WORK
16400	Comet Co		4		8:00	11:20	7:15		
16350	Day Chief Catalog		1		10:30	11:00	5		

---

Standard Uniform Cost Finding System Form 27. Revised 4. Machine Printers' Cost Computation

### PRESSROOM DAILY TIME TICKET

EMPLOYEE Y. C. Lee CLOCK NO. 3 DATE December 14 1917

"TIME OF WORK" COLUMN MUST BE FILLED IN, UNDER WORKING LETTERS ON BASIS OF QUOTAS. THIS SEPARATE TICKET FOR QUOTING AND TIME TICKET STAMPED "OVERSEEN" BY PERSON

JOB NUMBER	FOR WHICH	QUOTAS IN QUANTITY	TIME OF WORK	QUANTITY	TIME OF WORK	TIME OF WORK	TIME OF WORK	TIME OF WORK	TIME OF WORK
15850	Allegretto Co		28	7550	8:00	11:00	7:15		
16907	Morgan Co				8:00	11:00	7:15		
16400	Comet Co				8:00	11:00	7:15		

---

Standard Uniform Cost Finding System Form 28. Revised 4. Machine Printers' Cost Computation

### MACHINE COMPOSITION DAILY TIME TICKET

EMPLOYEE Allen MACHINE NO. 1 DATE December 1 1917

"TIME OF WORK" COLUMN MUST BE FILLED IN, UNDER WORKING LETTERS ON BASIS OF QUOTAS. THIS SEPARATE TICKET FOR QUOTING AND TIME TICKET STAMPED "OVERSEEN" BY PERSON

JOB NUMBER	FOR WHICH	QUOTAS IN QUANTITY	TIME OF WORK	QUANTITY	TIME OF WORK	TIME OF WORK	TIME OF WORK	TIME OF WORK	TIME OF WORK
16594					8:00	8:15			
15850					8:15	9:20	1:1		
					9:20	10:00	7:15		
					10:00	1:24	4		
15790	Office		101		1:24	1:44	2		
15902	Maytag Bros Co		101		1:44	2:48	1:1		
16400	Comet Co		101		2:48	3:00	2		

OFFICE (TIME TAKEN, CHARGING AND UNCHARGING COSTS OF THE MACHINERY ON THE DAY, MUST BE SET BY PERSON)

CHARGE - 7:15

"We warrant that the material filed on this form is correct and signed by the person, and sent to the office. This form is to be kept with the report and report are required to be kept."

## TIME TICKETS

On the several daily time tickets, such as Bindery, Compositors, Press Room and Machine Composition, the Comptometer can be used very advantageously. It exhibits the jobs, the time commenced and the time off; the time being recorded in hours and multiples of six minutes. The hours worked are determined mentally.

### Press Room Daily Time Tickets:

#### COMPTOMETER WORK

Add the non-chargeable hours and decimals, equals 5; then add the chargeable hours.

#### Machine Composition Daily Time Tickets:

Add the several closing times for each job, i. e.,

8 hours, 18 minutes  
9 " 30 "  
12 " "

etc.

in the following manner:

Add the minutes first, on the right of keyboard, 18, 30, 24, 42 and 48 = 162.

Divide this by 60 = 2.7 hours.

Now, add the hours to this amount, 8, 9, 12, etc., which shows in the register 43.7 hours.

Leave this in the register and on the left of keyboard add the commencing times in the same manner, equals 35.7 hours. Still, without clearing, subtract the commencing time total, 35.7 from the closing time total, 43.7, = 8 hours, total time charged.

Or— Prove the correct time distribution and totals by adding the commencing and closing time in hours and decimals of an hour, i. e.

Add the closing time on the right of keyboard, 8.3, 9.5, 12.00, etc., = 43.7. Then add the commencing time on the left of keyboard in the same manner, 8.00, 8.3, 9.5, etc., = 35.7.

Now, subtract the latter from the former, which equals the actual time worked, 8 hours.

Where the time worked has been an even day, 8 hours, of course it will not be necessary to prove in this manner.

## MAKING UP THE PAYROLLS

This, especially, is a phase of the work on which the Comptometer soon becomes invaluable. The payroll exhibits chargeable and non-chargeable hours in hours and tenths for each workman. The results required are:

- Total Chargeable Hours.
- Total Non-Chargeable Hours.
- Total Amount Due.
- Total Cost of Non-Chargeable Hours.
- Average Payroll Cost per Chargeable Hour.
- Percentage of Non-Chargeable to the Total Payroll.

Standard Uniform Cost Finding System. Form 4. Devised by American Printers' Cost Commission.

Hand Composition  
MAKE UP EACH DEPARTMENT SEPARATE

### DEPARTMENT PAY ROLL

WEEK ENDING December 21, 1917.

RECORD OVERTIME IN RED INK IN SAME LINE WITH NAME, ABOVE REGULAR TIME

Clock No.	NAME	MONDAY		TUESDAY		WEDNESDAY		THURSDAY		FRIDAY		SATURDAY		TOTAL CHARGEABLE HOURS	TOTAL NON CHARGEABLE HOURS	RATE	TOTAL AMOUNT	COST OF NON CHARGEABLE HOURS																
		CHARGEABLE	NON CHARGEABLE	CHARGEABLE	NON CHARGEABLE	CHARGEABLE	NON CHARGEABLE	CHARGEABLE	NON CHARGEABLE	CHARGEABLE	NON CHARGEABLE	CHARGEABLE	NON CHARGEABLE																					
	Husser	6	1	9	5	5	7	5	1	6	5	5	7	5	6	6	1	4	37	2	10	8	76	-	76	00	585							
	Ngath	5	3	5	2	7	8	7	4	6	6	1	4	9	7	1	5	1	7	9	20	2	17	8	71	-	71	00	778					
	Kripps	8		6	5	1	5	7	5	5	6	7	1	8	5	2	7	8	5	4	2	6	3	9	2	8	7	71	-	71	00	381		
		19	1	4	9	17	2	6	8	21	9	2	1	19	8	4	11	6	12	4	17	1	6	9	106	7	37	3	68	-	68	-	17	44

TOTAL DEPARTMENT PAY ROLL 68.00

TOTAL CHARGEABLE HOURS 106.7

AVERAGE PAY ROLL COST EACH CHARGEABLE HOUR .64

RATIO OF NON-CHARGEABLE TO TOTAL PAY ROLL 25%

## DEPARTMENT PAYROLL—Continued

### COMPTOMETER WORK

Cross-add the Chargeable and Non-Chargeable hours at the same time for each workman.

i. e., for Husser:

Cross-add the chargeable hours on the left of Keyboard and the non-chargeable hours on the right.

6.1	1.9
5.5	2.5
etc.	etc.

37.2 Chargeable Hours.    10.8 Non-Chargeable Hours.

Cross-add the chargeable and non-chargeable hours for each workman in this manner.

### Cost of Non-Chargeable Hours:

A card is made up showing the hourly rate at the different weekly wages, as —

\$26.00 per week equals 54 1/6c per hour.

\$21.00 per week equals 43 3/4c per hour.

Hold the hours for Key Factor over the Fixed Decimal and multiply the rate per hour, as —

.5417 x 10.8 = \$5.85

.4375 x 17.8 = 7.78

Continue in the same manner for all Non-Chargeable Hours.

### Balancing the Department Payroll Sheet:

Add the Chargeable and Non-Chargeable hours for daily totals.

i. e., Monday:

6.1	1.9
5	3
8	

19.1 Chargeable Hours.    4.9 Non-Chargeable Hours.

Add also the total hours, the total amounts and the non-chargeable hour costs, e. g., "Total Chargeable Hours," 37.2, 30.2, etc. = 106.7.

Cross-add the daily total Chargeable and Non-Chargeable hours in the same manner as previously.

19.1	4.9
17.2	6.8
etc.	etc.

106.7 Chargeable Hours.    37.3 Non-Chargeable Hours.

Proving against the corresponding totals.

### Average Cost per Chargeable Hour:

The chargeable hours in the department were 106.7 and the payroll \$68.00; therefore, merely add the amount of payroll, \$68.00, in the Comptometer at the left and divide by the chargeable hours, 106.7 = \$.64 per Chargeable Hour.

### Ratio of Non-Chargeable to Total Payroll:

Add the non-chargeable cost, \$17.44, in the Comptometer at the left and divide by the total payroll, \$68.00 = 25%.

The Ten-Column Comptometer is ideal for this work. It allows the use of the Fixed Decimal and the handling of both chargeable and non-chargeable hours at the same time.

## MONTHLY RECORDS

Monthly records are usually made up to exhibit the total number of chargeable and non-chargeable hours in each department.

Standard Uniform Cost Finding System, Form 6, Divided by American Printers Cost Commission

Monthly Record of Department Chargeable and Non-Chargeable Hours  
For Month of December 1917

DATE IN DEPT HEADS		<u>Press Comp.</u>		<u>Archives Comp.</u>		<u>Bindery A</u>		<u>Bindery B</u>		<u>Bindery C</u>		<u>Bindery D</u>		DATE
DATE	CHARGEABLE	NON-CHARGEABLE	CHARGEABLE	NON-CHARGEABLE	CHARGEABLE	NON-CHARGEABLE	CHARGEABLE	NON-CHARGEABLE	CHARGEABLE	NON-CHARGEABLE	CHARGEABLE	NON-CHARGEABLE	DATE	
1													1	
2	17	4	7	6									2	
3	18	7	4	8									3	
4	19	1	4	9									4	
5	19	7	6	8									5	
6	21	9	7	1									6	
7	19	8	4	7									7	
8													8	
9	11	6	17	4									9	
10	12	9	10	1									10	
11	27	5	4	5									11	
12	28	7	7	2									12	
13	20	6	3	4									13	
14	19	9	4	1									14	
15													15	
16	21	9	7	1									16	
17	20	7	3	3									17	
18	22	6	4	7									18	
19	23	6	6	4									19	
20	22	5	2	6									20	
21	24	7	7	8									21	
22													22	
23	25	4	4	6									23	
24	26	1	3	9									24	
25													25	
26	20	7	2	8									26	
27	23	7	8										27	
28	20	4	4	6									28	
29	19	7	4	8									29	
30	16	4	7										30	
31													31	
540	112	9	148	8	41	5	146	141	4					

**Monthly Record of Department Hours:**

**COMPTONETER WORK**

Add the number of both chargeable and non-chargeable hours for each department.

For Example:

17.4	2.6
19.2	4.8
19.1	4.9
etc.	etc.
<b>Total 680.1 Chargeable Hours</b>	<b>115.9 Non-Chargeable Hours</b>

Similar data is worked up for each press in operation, as illustrated on following page.

Standard Uniform Cost Finding System. Form 6. Derived by American Printers' Cost Committee

## Monthly Record of Chargeable and Non-Chargeable Hours and Press Impressions

 For Month of December 1917

PRESS NO. 3						PRESS NO. 4					PRESS NO. 5																					
DATE	MAKE READY	RUNNING	IMPRESSIONS	NON CHARGEABLE	IDLE TIME	MAKE READY	RUNNING	IMPRESSIONS	NON CHARGEABLE	IDLE TIME	MAKE READY	RUNNING	IMPRESSIONS	NON CHARGEABLE	IDLE TIME	DATE																
1																1																
2	3.5	2.6	5500		9.1											2																
3		2.3	5000		7											3																
4		2.5	12000		5											4																
5	1	4.5	6700	1	1.5											5																
6	1.5	3.4	4775	1.5	7.6											6																
7		6.7	10290	8	5											7																
8																8																
9	1				2.3											9																
10	1.7	1	1000	1.8	3											10																
11	1.5	3	2076	1.5	1											11																
12	3	1.5	7575		7.5											12																
13	1.5	6	1975	5												13																
14	1.3		5160	1.2	5											14																
15																15																
16	1.1	5	350		7.4											16																
17	3.7	1.5	1159	1	7.3											17																
18	1	2.8	5100	5	7.7											18																
19	1.4	2.5	5085	1	7.5											19																
20	1.8	1	50	6.5	4											20																
21	1.5	5.5	6750													21																
22																22																
23		3.7	5100													23																
24		1.7	10700													24																
25																25																
26	4.7	2.8	5700													26																
27	1.7	5.1	6640													27																
28	1.3	6.4	9700													28																
29		6.3	4740													29																
30	1.5															30																
31																31																
27	4	8.9	8	17	20	17	14	9	40	4	20	7	85	6	10	42	70	50	5	70	4	24	7	97	8	12	4	15	11	2	32	4

**MONTHLY RECORD OF PRESS WORK.**

The data wanted from each press are the hours consumed in "Make Ready", hours of running time, non-chargeable hours and idle time; also the number of impressions. These items are taken from the time records.

**COMPTOMETER WORK**

Add the hours and tenths under each heading.

**For Example:**

"Make Ready" 3.5, 1, 1.5, etc., = 37.4 hours. Add the number of impressions, e.g., 5500, 5000, 12000, etc., = 123077.

## COST OF PRODUCTION STATEMENT

The more up-to-date printing establishments have a desire to know exactly where they stand each month; that is, they want to know the exact amount of money paid out for the different classes of expense as a total and also as these various classes of expense relate to the several departments. In this manner they can determine the exact cost per hour in each department and are thus enabled to establish a price either on an estimate or for day work.

The department investment, which is taken from the inventory, is entered on the "Cost of Production Sheet" for each department. This amount may increase or decrease from month to month if deductions or additions are made to the inventory. The total expenditures, for Payroll, \$1,862.93, for Rent and Heat, \$110.00, for Light, \$22.98, etc., are first entered in the Total Expense column from the ledger accounts.

### Distribution—Payroll

The payroll items for each department are abstracted direct from the time reports.

### COMPTOMETER WORK

#### Rent and Heat:

This expense is prorated on the basis of sq. ft. of floor space occupied by each department. The total floor space is 5,500 sq. ft.; cost of "Rent and Heat," \$110.00.

The first step is to determine the cost per sq. ft. of floor space; therefore, add \$110.00 in the Comptometer at the left and divide by 5,500, = 2c per sq. ft., Floor Space Cost.

Clear the Comptometer and multiply the cost per sq. ft. by the number of sq. ft. in each department, that is for Stock Handling and Shipping, hold 650 (floor space) at the right of keyboard and multiply the price (cost per sq. ft.). Point off two places, equals, \$13.00.

Clear and hold 670 (floor space for office, etc., classified under "General Expense,") and multiply the price in the same manner, equals \$13.40, "Rent and Heat" prorated for general expense.

The expenses for the other departments are prorated in the same manner.

#### Light:

The light is prorated on the basis of the percentage of lights in each department. The percentage being only two decimals, it is well to figure the lowest percentage first. Then leave that result in the register and merely multiply the difference to the next higher percent.

i. e., hold 22.98 on right side of keyboard and multiply three times for "Stock Handling and Shipping," equals .6894 (enter as 69c).

The next higher percent is 4, so, leaving this first result, .6894, in the register, hold 22.98 and multiply once more, equals .9192, which enter as 92c for "General Expense" and Binderies "A," "C" and "D."



### **COST OF PRODUCTION**

[illegible]

### COST OF PRODUCTION STATEMENT—Continued

Again, leaving .9192 in the register, hold 22.98 and multiply three times, equals the Job Press proration of 7%, 1.6086 (enter as 1.61).

Again, multiply four times more for Hand Composition, 11%, equals 2.5278 (enter as 2.53).

Then multiply 2.5278 two times more for 33%, Machine Composition, equals 7.5834 (enter as 7.58).

Now clear the machine and multiply by 30% for Cylinder Press, equals 6.89.

#### Power:

The Cost of Power is prorated on the basis of Horse Power used or the Meter Statement of Current used in each department.

Prorate in the same manner as the "Light," i. e., hold 38.28 for Key Factor (splitting and holding first 38, then 28), and multiply each department's percent.

10% for Machine Composition..	=	\$ 3.83
50% for Cylinder Press.....	=	19.14
15% for Job Press.....	=	5.74
20% for Bindery A.....	=	7.65
5% for Bindery C.....	=	1.92

Cross-add prorated amounts for proof.

#### Insurance and Taxes:

The total for the year is determined and then divided by 12 to arrive at the cost per month. Each month's proportion is then distributed over the departments according to the inventory.

First, find the expense per dollar of inventory, i. e., add amount of Insurance and Taxes, \$56.84, in the Comptometer at the left and divide by the Total Amount of Inventory, \$29,168.00, = \$.0019487, Expense per Dollar of Inventory.

Hold same for Key Factor (splitting and using first 19, then 487) and multiply the amount of each department's inventory, equals \$6.10 for Stock Handling and Shipping, \$3.13 General Expense, etc.

#### Interest on Department Investment:

This is figured on a basis of 6% per annum, or  $\frac{1}{2}$  of 1%, = .005 per month on the department investment.

Hold the rate, .005, for Key Factor and multiply the even dollars of each department inventory, equals \$15.64 for Stock Handling and Shipping, \$8.02 for General Expense, etc.

#### Depreciation:

The amount of depreciation is determined by figuring certain established percentages on the inventories. These percentages of depreciation will vary according to the class of equipment. For instance, it is customary to figure a depreciation of 25% on Type and 10% on other equipment in the Composing Room. The percentage of annual depreciation, of course, will be divided by 12 for each monthly percentage.

## COST OF PRODUCTION STATEMENT—Continued

Bad Debts, Spoiled Work, Direct Expense, etc., are abstracted from the ledger accounts.

The items under Stock Handling and Shipping are added and included with the General Expense. Add the General Expense items, \$847.69, \$13.40, \$.92, etc., = \$1,282.45

### Distribution—General Expense

The "General Expense" is prorated on the basis of department costs; therefore, first cross-add the items of Department Costs, \$365.07, \$186.84, etc., = \$1,549.67. Then determine the amount of expense to be prorated for each dollar of Department Costs, that is, add the "General Expense," \$1,282.45, in the Comptometer at the left and divide by the "Department Cost," \$1,549.67, = .82756. Hold this amount at the left of Keyboard for Key Factor, splitting and hold first 82, then 756 and multiply each departmental cost item.

### FOR EXAMPLE:

$$\$365.07 \times .82756 = \$302.12.$$

Figure each department distribution in the same manner.

### Total Cost of Departments:

Add the cost and general expense items for each department, e. g.,

"Hand Composition," \$365.07, \$302.12, = \$667.19.

### Chargeable Hours for Each Department:

These items are abstracted from the Payroll Records.

### Net Cost per Chargeable Hour:

The total "Chargeable Hours" of Hand Composition are 520.1 and the Total Cost, \$667.19; therefore, add the Cost, \$667.19, in the Comptometer at the left and divide by the Chargeable Hours, 520.1, = \$1.28.

Figure the cost per Chargeable Hour for each department in the same manner.

### Average Net Cost per Hour (Six Months).

Add the net cost for each month in the Comptometer and divide by the number of months (these items are not given).

### Percentage of Productive Time:

This item is figured from the Payroll by dividing the total time by the "Productive Time."

### Payroll Cost per Chargeable Hour:

The Payroll for Hand Composition is \$271.69, while the hours are 520.1; therefore, add the amount of Payroll, \$271.69, in the Comptometer at the left and divide by the Chargeable Hours, 520.1, = 52c.

### Department Cost per Chargeable Hour:

The Department Cost is \$365.07 and the Chargeable Hours 520.1. Add the Department Cost, 365.07, in the Comptometer at the left and divide by the Chargeable Hours, 520.1 = 70c.

The Payroll and Department Cost per Chargeable Hours are determined for each department in the same manner.



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## THE COMPTOMETER IN CREAMERIES AND DAIRIES

Efficiency of the clerks employed on all of the following work can be increased to a surprising degree.

### **Bookkeeping:**

- Proving Daily Postings,
- Balancing Accounts,
- Taking Off Trial Balances,
- Adding Cash and Deposit Slips,
- Adding and Balancing Check Register,
- Proving Bank Statements, etc.

### **Butter Fat Department:**

- Adding Quantities, Amounts, etc.,
- Figuring and Proving Patrons' Accounts,
- Figuring and Proving Butter Fat.

### **Billing Department:**

- Figuring all Extensions by Pound, Gallon, Dozen, etc.
- Footing all Invoices,
- Proving and Checking,
- Extending and Deducting Freight.

Besides the saving in time, the Comptometer eliminates mistakes. In extending and proving invoices, you can figure fractions both in quantity and in price as easily as whole numbers.

### **Statistical Department:**

- Adding Cost and Profit per Department,
- Figuring Average Tests,
- Figuring Expense Per Pound of Butter Fat,
- Figuring Percent Loss and Gain over Tests,
- Figuring Percentages of all kinds.

### **Timekeeping:**

- Figuring Time Cards,
- Extensions on Payrolls per Day, Hour, Gallon, Pound,
- Totaling Payrolls, etc.

### **THE CREAMERY BOOKKEEPER AND THE COMPTOMETER**

The daily postings can be proved in from 5 to 10 minutes each day by using the Comptometer and Debit and Credit Markers.

It takes very little time and effort and enables immediate detection of:—

- Any Posting on Wrong Side of Account,
- Posting of the Wrong Amount,
- Transposition of Figures.

For Comptometer method of Proving the Daily Postings,

- Balancing Ledger Accounts,
- and

Trial Balances—

See Index for "Bookkeeping".

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## GENERAL ACCOUNTING WORK

The systems employed in the General Accounting Work of Creameries and Dairies vary, greatly.

The one fact is apparent that there are volumes of—

Additions to make,  
Butter Fat to figure,  
Milk at price per gallon,  
Percentages to figure,  
Statistical data to work up.

And the Comptometer is the one practical machine on every detail of this work.

## BUTTER FAT DEPARTMENT

Station Report					
Butter-Cup Creamery Company Chicago, Illinois					
Station <u>Merritt, Neb.</u>					
Agent <u>V. A. James</u> Date <u>4/7/12</u>					
PATRON	CREAM	TEST	B. F.	PRICE	AMOUNT
<u>J. Finney</u>	<u>126</u>	<u>32</u>	<u>40.3</u>	<u>26½</u>	<u>10 68</u>
<u>C. A. Hardy</u>	<u>76</u>	<u>37</u>	<u>28.1</u>		<u>7 45</u>
<u>L. V. Smith</u>	<u>162</u>	<u>41</u>	<u>66.4</u>		<u>17 60</u>
<u>H. W. Gordon</u>	<u>46</u>	<u>29</u>	<u>13.3</u>		<u>3 52</u>
<u>A. B. Corby</u>	<u>236</u>	<u>34</u>	<u>80.2</u>		<u>21 25</u>
<u>M. V. Avery</u>	<u>146</u>	<u>32</u>	<u>46.7</u>		<u>12 38</u>
	<u>792</u>		<u>275</u>		<u>72 88</u>

## METHOD

1st: Add the quantities of  
Cream, 126, 76, etc., = 792 lbs.

2nd: Multiply the lbs. of  
Cream by the test.  
Hold the test for Key  
Factor at right of  
Keyboard and multi-  
ply the cream  
 $126 \times .32 \dots\dots = 40.32 \text{ lbs. B. F.}$

Jot down the result and prove, i. e.—

Leave this in the ma-  
chine, and, over it,  
multiply  $126 \times 32$   
negatively, i. e.—hold  
the negative of 32,  
(small 31) for Key  
Factor, and multiply  
 $126 \dots\dots 12,600$ , proving the  
multiplication

Figure and prove all  
Butter Fat quanti-  
ties in this manner.

3rd: Extend the Butter Fat  
quantities by the price  
per lb.—

$40.3 @ 26\frac{1}{2}c \dots\dots \$10.68$

$28.1 @ 26\frac{1}{2}c \dots\dots 7.45$

etc.

4th: Add the money  $\dots\dots \$72.88$

Add the Butter Fat  $\dots\dots 275 \text{ lbs.}$

and multiply by price per lb.,  $26\frac{1}{2}c$ , for proof \$72.88.

In figuring Butter Fat the hundredths of lbs. are usually disregarded.

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**BUTTER FAT DEPARTMENT**

**PATRONS' MILK SHEETS**

The purchase of milk on the basis of Butter Fat contained is the prevailing method with Creameries and Dairies.

The proven accuracy and efficiency acquired with the Comptometer is a source of satisfaction to the management and a pleasure to the clerks.

The above includes 22 additions and 25 extensions. The original additions and extensions are made and proven on the Comptometer in 8 to 15 minutes, a fraction of the time required mentally.

The satisfaction with the Comptometer method is that every step is positively proven.

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## COMPUTING PATRONS' MILK SHEETS

The following is based on the price per gallon, the price varying according to the test.

Some Dairies accept milk at  $8\frac{1}{2}$  lbs. per gallon. Others figure it at 8.6 lbs.

The example given below is based on—  
8.6 lbs. per gallon.

Price  $12\frac{1}{2}$ c for 4% milk, and increasing 4 cents for each 1% test or 2 mills for each .05% test.

PATRON	POUNDS MILK	TEST	PRICE GAL.	AMOUNT	
<i>J. Jones</i>	<i>1726</i>	<i>3.80</i>	<i>11.7</i>	<i>23</i>	<i>48</i>
<i>Midsmith</i>	<i>2346</i>	<i>4.05</i>	<i>12.7</i>	<i>34</i>	<i>64</i>
<i>A. Gaynes</i>	<i>1432</i>	<i>4.35</i>	<i>13.9</i>	<i>23</i>	<i>15</i>
<i>Olney Bank</i>	<i>1632</i>	<i>4.60</i>	<i>14.9</i>	<i>28</i>	<i>28</i>
<i>H. Green</i>	<i>3465</i>	<i>4.70</i>	<i>15.3</i>	<i>61</i>	<i>64</i>
<i>Sam. Haynes</i>	<i>2645</i>	<i>5.15</i>	<i>17.1</i>	<i>52</i>	<i>59</i>
	<i>13246</i>			<i>223</i>	<i>78</i>

## METHOD

The price per gallon is determined, at a glance, from the test, by one who is accustomed to this class of work.

The basic price of  $12\frac{1}{2}$ c per gallon is treated as 125 mills. As the price changes 2 mills with each .05% change in test, it is the same as .4 mills for each one-tenth of one per cent test, or each .10%.

To determine the price by the test—multiply the number of tenths and hundredths of test over or under the 4% basis by .4 equals the number of mills to add or deduct from basic price, i. e.—

3.80% test is .20 below basis.

$20 \times .4 = 8$  mills

$125 - 8 = 11.7$ c per gallon

4.35% test is .35 above basis.

$.35 \times .4 = .14$  mills

$125 + 14 = 13.9$ c gallon.

Having determined the price per gallon, find the price per pound on accompanying Table and multiply by the pounds; i. e.—

1726 lbs. @ 11.7c per gallon is @1.3605c per lb.

2346 lbs. @ 12.7c per gallon is @1.4767c per lb.

Hold the pounds for Key Factor over the Fixed Decimal and multiply the price per lb.

When the lbs. run into 4 figures, split the Key Factors,  $1726 \times 1.3605$  cts. = 23.48

$2346 \times 1.4767$  cts. = 34.64 etc.

As the rates are recorded in Cents, the decimal in answer will, of course, be two places to the left of the Fixed Decimal.

THE EQUIVALENT POUND PRICES OF MILK IN CENTS AT 8.6 POUNDS PER GALLON.									
8¢	9¢	10¢	11¢	12¢	13¢	14¢	15¢	16¢	17¢
8 .9302	9 1.0665	10 1.1628	11 1.2791	12 1.3965	13 1.5139	14 1.6312	15 1.7485	16 1.8658	17 1.9831
8.1 .9419	9.1 1.0801	10.1 1.1744	11.1 1.2907	12.1 1.4070	13.1 1.5233	14.1 1.6396	15.1 1.7558	16.1 1.8721	17.1 1.9884
8.2 .9535	9.2 1.0698	10.2 1.1850	11.2 1.3023	12.2 1.4186	13.2 1.5349	14.2 1.6512	15.2 1.7674	16.2 1.8837	17.2 2.0000
8.3 .9651	9.3 1.0014	10.3 1.1977	11.3 1.3140	12.3 1.4302	13.3 1.5465	14.3 1.6628	15.3 1.7791	16.3 1.8953	17.3 2.0116
8.4 .9767	9.4 1.0930	10.4 1.2093	11.4 1.3256	12.4 1.4419	13.4 1.5582	14.4 1.6744	15.4 1.7907	16.4 1.9070	17.4 2.0233
8.5 .9884	9.5 1.1047	10.5 1.2209	11.5 1.3372	12.5 1.4535	13.5 1.5698	14.5 1.6860	15.5 1.8023	16.5 1.9186	17.5 2.0349
8.6 1.0000	9.6 1.1163	10.6 1.2326	11.6 1.3489	12.6 1.4652	13.6 1.5815	14.6 1.6977	15.6 1.8140	16.6 1.9303	17.6 2.0465
8.7 1.0116	9.7 1.1279	10.7 1.2442	11.7 1.3605	12.7 1.4767	13.7 1.5930	14.7 1.7093	15.7 1.8256	16.7 1.9419	17.7 2.0581
8.8 1.0233	9.8 1.1395	10.8 1.2558	11.8 1.3721	12.8 1.4884	13.8 1.6047	14.8 1.7209	15.8 1.8372	16.8 1.9535	17.8 2.0698
8.9 1.0349	9.9 1.1512	10.9 1.2674	11.9 1.3837	12.9 1.5					
13¢	14¢	15¢	16¢	17¢					
13 1.5116	14 1.6279	15 1.7442	16 1.8605	17 1.9767					
13.1 1.5233	14.1 1.6396	15.1 1.7558	16.1 1.8721	17.1 1.9884					
13.2 1.5349	14.2 1.6512	15.2 1.7674	16.2 1.8837	17.2 2.0000					
13.3 1.5465	14.3 1.6628	15.3 1.7791	16.3 1.8953	17.3 2.0116					
13.4 1.5582	14.4 1.6744	15.4 1.7907	16.4 1.9070	17.4 2.0233					
13.5 1.5698	14.5 1.6860	15.5 1.8023	16.5 1.9186	17.5 2.0349					
13.6 1.5815	14.6 1.6977	15.6 1.8140	16.6 1.9303	17.6 2.0465					
13.7 1.5930	14.7 1.7093	15.7 1.8256	16.7 1.9419	17.7 2.0581					
13.8 1.6047	14.8 1.7209	15.8 1.8372	16.8 1.9535	17.8 2.0698					
13.9 1.6163	14.9 1.7326	15.9 1.8488	16.9 1.9651	17.9 2.0814					



## INVOICING

Invoicing is a feature that particularly requires accuracy.

The ease of the original extensions and footings with the Comptometer, and then the positive proof through accumulative extending makes the combination of Comptometer and Typewriter the ideal billing assistants.

## BILLING

WM. GINGLE & SONS, DR. Washington, D. C. TO U. S. CREAMERY & DAIRY CO.				
DATE	QUANTITY	DESCRIPTION		NET EXTENSION
Dec. 10	1465	Butter, Grade "C"	@ 26½c	\$388.23
	782½	" " "A"	" 34½c	269.96
	240 doz.	Eggs	" 27c	64.80
	96 "	"	" 29c	27.84
				<u>\$750.83</u>

## METHOD

Hold the Price for Key Factor, over the Fixed Decimal, and multiply the quantity—

$$1465 \times .265 = 388.23$$

$$782.5 \times .345 = 269.96, \text{ etc.}$$

Add the results = \$750.83.

Prove by extending over the Fixed Decimal, accumulating to the total.

The above invoice is easily extended, results written down, footed and accumulatively proven in 1½ minutes.

## ACCURACY IS ASSURED

In the proof, the Comptometer figures the extensions over a Fixed Decimal and automatically adds the results at the same time. It eliminates every possibility of a compensating error.

## COST ACCOUNTING

EXPENSE PER POUND OF BUTTER FAT  
Carried Out to the Fifth Decimal

Station Melrose, N. Y.			
	BUTTER FAT REC'D	EXPENSE	AVG. EXPENSE
	238.4	fat 2.52	
	965.3	" 1.65	
	247.6	" 1.71	
	462.5	" 3.20	
	1314.8	com 1.74	
		ctg .87	
		11.69	00889

## METHOD

Place the Comptometer right beside the records.

First add the Butter Fat..... = 1314.8

Then clear and add the "expense" at the

left of Keyboard..... 11.69

Leave this in the machine and divide by the lbs. of Butter Fat.

We see at a glance the first two places in the answer will be ciphers, hence only 3 digits in the answer, therefore use first 4 figures of divisor, i. e., 1315. = .00888, Rem. 1280.

Clear and prove, i. e., multiply from the right, .00888 × 1315 = 1167720

Add in the Rem. 1280

1169000

Or, use the Comptometer "Reciprocal Table," and obtain the same results by multiplying.

A history of each Station's business is thus easily and quickly secured, and the data is at hand for a ready comparison of Station Values and Agents.

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**BALANCING DRIVERS' DAILY REPORTS**

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### FIGURING MILK AND CREAM MIXTURE

Much of the mixing of Milk and Cream, to obtain a desired quality, has been done by the "Mix and Test" process.

The Comptometer affords a quick and easy method of determining exact quantities for any mixtures—

#### EXAMPLE:

How much milk and how much cream required for 60 lbs. of mixture that will test  $11\frac{1}{2}\%$ . The milk tests  $4\%$  and the cream tests  $28\frac{1}{2}\%$ .

#### METHOD

Multiply the Mixture by the Mixture Test, preferably over Fixed Decimal,  $60 \times 11\frac{1}{2}$  equals 6.9.

Clear and multiply the Mixture by the Cream Test,  $60 \times 28\frac{1}{2}$  equals 17.1.

Subtract the first result,  $17.1 - 6.9$  equals 10.2.

Find the difference between Milk Test and Cream Test,  $28\frac{1}{2} - 4$  equals  $24\frac{1}{2}$ .

Divide this difference into the above result,  $10.2 \div 24\frac{1}{2}$  equals 41.6 pounds of Milk.

The quantity of Cream will be the difference between the pounds of Milk and the Total Mixture,  $60 - 41.6$  equals 18.4 pounds of Cream.

Or, better still, with the 41.6 pounds of milk in the Register, subtract the 60 pounds negatively without clearing the machine. (See Instruction Book.)

If desired, the Comptometer Reciprocal Table can be used, which performs the work in **three multiplications and one subtraction**.

**Easier to figure than to mix.** All done by the simple operation of the keys. Your mixture is to exact specifications without waste or deductions and you are relieved of the uncertainties of the "Mix and Test" method.

## COST ACCOUNTING

## OVER AND SHORT DEPARTMENT

STATION	REC'D	PD. FOR	LBS. LOSS	LBS. GAIN	B. F.	AV. TEST	@	COST
Lidney	1550	1614	64		466.6	.301	26 1/2	1236.5
Narver	849	817		32	317.5	.374	26	825.5
Lincoln	1246	1267	21		439.8	.353	26 1/2	1165.5
Doorn	1670	1660		10	517.7	.310	26 1/2	1371.9
Elmhurst	1230	1230		10	387.5	.315	26	1097.5
Bellan	760	800	40		258.4	.340	26	671.8
Perian	890	920	30		312.4	.351	26 1/2	827.9
Davenport	1421	1390		31	454.7	.320	26	1182.2
	9616.0	9688	155	83	5154.6			8785.8

The Comptometer makes this work so easy and speedy that, with its use, this data can be obtained with a minimum expenditure of time and energy.

## THE MONTHLY STATEMENT

On this statement, the Comptometer is employed in—

Totaling the quantities,  
 Making the deductions,  
 Figuring the Cost per pound of Butter Fat,  
 Figuring the Cost per pound of Butter,  
 Figuring the Cost per pound of Butter and Butter Fat in each individual item of expense.

Many Creameries desire to know:

The actual loss or gain of Butter Fat as compared to the quantity paid for.

The per cent of same for each Station.

The amount of Butter Fat determined by the average test.

Its actual cost based on the quantity received, etc.

## METHOD

Subtract for the "lbs. loss and lbs. gain" usually mentally as this is seen at a glance.

Add the quantities received.

Add the quantities paid for.

Add the "lbs. loss" and the "lbs. gain."

Add the quantities received and the quantities paid for.

Leave the last amount in the machine and prove the four additions thus—

Add to the "lbs. loss" ..... 9688

83

9771

Subtract the "lbs. gain" ..... 155

Proves against the quantity received ..... 9616

The amount of work on statistical data has prohibited many from getting the fullest information relative to their business.

## OFFICE OF THE FARMERS' CO-OPERATIVE CREAMERY, OMAHA, NEBRASKA

(Office Manager at Left of Picture)

Here, Comptometer Efficiency is especially valuable. These are the vital statistics of the Creamery Industry.

They usually cost the time of the Office Manager.

## COST ACCOUNTING AND THE COMPTOMETER

## METHOD

Add the "Fat Purchased" .....	456431.4
Subtract the "Loss in Testing" .....	20075.6
	436355.8
Add the "Inventory" .....	23731.7
	460087.5
Subtract the "Sales and Inventory" .....	32814.4
	427273.1
Clear and add in the machine the "Butter Produced" ...	540961.
Subtract the "Fat Churned" .....	427273.
Equals "Churn Overrun" .....	113688.
Subtract the "Loss in Printing" .....	618
"Net Overrun" .....	113070
Add the "Testing Loss" .....	20075
Equals the "Commercial Overrun" .....	133145

## Figure the "Costs Per Pound of Butter Fat."

Add the "Cost From Station" in the machine at the left 110,286.14  
 Divide by the "Quantity Received" 451018.2 ..... 24453, etc.  
 Clear and prove the Division. Continue in the same manner with each "Cost Per Pound" item.

## Figuring the "Cost Per Pound" on "Added Charges."

Each item of "Added Charges":—Transportation, 7408.12, Station Commission, 8739.00, etc., must be divided by the Net Butter Fat Purchased, 436355.8.

As 436355.8 is a Constant Divisor for the several items, use the Reciprocal Method:—

Divide 436355.8 into 1, carrying the Reciprocal to the 4th figure ..... = 2292.

Then hold the Reciprocal for Key Factor and multiply each item separately from the left of Keyboard.

(\*) 7408 × 2292 ..... 01698.  
 8741 × 2292 ..... 02003, etc.

(Split the Key Factor and multiply through by 22, holding with the first finger of each hand, then shift to 92 keys at the right and multiply back towards the left.)

## Figuring "Cost Per Pound" on "Butter" and "Added Charges."

Divide the "Total Butter Produced," 540961 lbs., into 1 for Reciprocal ..... = 1849  
 and multiply each amount by same. Split the Key Factor 1849 as before.

7408 × 1849 ..... 01370  
 8741 × 1849 ..... 01616

(\*) See Reciprocal method "of pointing off."

## THE MONTHLY STATEMENT

Creamery—Butter Cost Statement—Month of August, 1912.				
FAT PURCHASED	POUNDS	MONEY	PER POUND FAT	PER POUND BUTTER
From Station	451018.2	110286.14	24453.44	24453.44
From Individuals	2419.7	622.65	257.21	257.21
From Milk	2999.5	1450.71	483.65	483.65
Total Fat Purchased	456431.4	112359.50	2461.9	2461.9
Loss in Testing	20075.6			
Net	436355.8		2575.2	
Plus Inventory July 31	23731.7	7119.51		
Net	460087.5	11949.01		
Less Sales and Inventory	12409.1	4363.24		
	19405.3	6025.64		
Fat Churned	427273.1	109100.13	2553.4	2017.2
Butter Produced	540961.			
Churn Overrun	113688.		266.1	
Loss in Printing	618			
Net	113070.		264.5	
Loss in Testing	20075.			
Commercial Overrun	133145.		2088	
Net Cost of Fat in 540,961 Pounds Butter		109100.13		2017.2
ADDED CHARGES				
Transportation		7408.12	01698	01370
Station Commission		8739.00	02003	01616
Station Expense		2464.25	00565	00456
Superintendent's Salary		725.00	00166	00134
Superintendent's Expense		862.50	00198	00159
Office Labor and Incidentals		1140.79	00261	00211
Maintenance and Building Repair		184.00	00042	00034
Can Depreciation		956.80	00219	00177
Supplies—Packages, Cartons, etc.		2651.58	00608	00490
Supplies—Factory		707.22	00162	00131
Factory Labor		2907.88	00667	00539
Administrative Expense		800.00	00183	00148
Stable Expense		830.4	00019	00015
Factory Expense				
Factory Expense—Power, Light and Refrig.		152.05	00035	00028
Rent		200.00	00046	00037
Incidentals		1603.33	00367	00296
Total Added Charges		31585.56	07229	05840
Total Cost of 540,961 Pounds Butter		140685.69		26012



# **RAILROADS**

OFFICE OF THE AUDITOR OF FREIGHT ACCOUNTS,  
PENNSYLVANIA R. R., PHILADELPHIA, PA.



## MECHANICAL ARITHMETIC APPLIED TO RAILROAD ACCOUNTING

### LOCAL FREIGHT WORK

Freight is divided into several classes, each class taking a different rate; for instance:

The rate to a certain point on first class freight may be 27 cents;

The rate to a certain point on second class freight may be 23½ cents;

The rate to a certain point on third class freight may be 18 cents;

The rate to a certain point on fourth class freight may be 14½ cents, etc.,

while still other articles may take rates based on the above, such as one and one half times First Class Rate,  $27 \times 1.5 = .405$  rate, etc.

The rates may be based on:

Hundredweight (Cwt.)	
Net Ton	2000#
Gross Ton	2240#
Sand Ton	2268#
or Baskets and Crates.	

#### Abbreviations

C. L.	Car Load.
L. C. L.	Less than Car Load.
P. P.	Prepaid.
Adv.	Advances.
Frt.	Freight.
W.-B.	Way-Bill.
S. O.	Shipping Order.

### MINIMUM CHARGE

The rate for 100 lbs. will be the minimum charge for any single shipment of less weight; i. e.—

65% of Furniture from Chicago to Dundee, N. Y. Rate 78c Cwt. would be billed at a minimum charge of \$.78.

### LOCAL REPORTS

The railroads employ principally two methods for reporting Local Freights, Received and Forwarded, viz.,—

The Daily Basis  
and the Monthly Basis

#### THE DAILY BASIS

On the daily basis, the bulk of the accounting is done daily. The Agent makes up "Forwarded and Received" Abstracts of shipments daily and forwards to the General Office. The columns of Weights, Freight Charges, Advances and Prepays are added daily and the totals posted to a Summary Sheet. This Summary is added and balanced at the end of the month.

The Received Way-Bills are first revised, then entered in a "Received Bill Register."

A Blanket Way-Bill is one covering the billing of shipments to several consignees. Each is recorded separately in the Bill Register, for the convenient stamping off of the Paid items.

#### THE MONTHLY BASIS

A "Bill Register" is kept for each, the "Forwarded" and the "Received" Way-Bills. This contains the same information as the Forwarded and Received Abstracts on the daily basis. It requires the adding daily of the Weights, Freight Charges, Advances and Prepays.

The Way-Bills are posted to a monthly report in station order, i. e., each station is given one or more pages and all shipments to that station recorded on same. At the end of the month, add the Weights, Freight Charges, Advances and Prepays and balance against the summary of the Bill Register.

## LOCAL FREIGHT OFFICES

The Shipper makes out the itemized Shipping Order. The Freight Handlers weigh the goods and check the items. The Shipping Order then goes to the office.

Rate Clerk fills in the rates, usually with red or green ink, so as to be easily distinguished.

The Shipping Order then goes to the Comptometer Operator for the figure work. Shipping Orders carrying the minimum charge go direct to the Bill Clerks.

FORM F. T. D. No. 1

**NEW YORK CENTRAL LINES** New York Central & Hudson River Railroad Company

Shippers No. 14768

Agents No. 785

**THIS SHIPPING ORDER** must be legibly filled in, in ink, in indelible pencil, or in carbon, and retained by the Agent.

RECEIVE, subject to the classifications and tariffs in effect on the date of issue of this Shipping Order,

at Detroit, Michigan, July 4, 1913.

Consigned to George S. Thomas,

Destination, Greenfield, State of Mass. County of U.S.A.

Route, via New York Central Car Initial CB Car No. 1724

NO. PACKAGES	DESCRIPTION OF ARTICLES AND SPECIAL MARKS	WEIGHT (Subject to Correction)	CLASS OR RATE	CHARGE	REMARKS
16	Brls. Flour	3480	21	731	If charges are to be prepaid, write or stamp here, "To be Prepaid."
6	Cases Tomatoes	365	16	58	
1	Brl. Sugar	470	08	39	
1	Box Prunes	100	26	26	
1	Bag Coffee	162	28	73	Received \$ to apply in prepayment of the charges on the property described hereon.
			90		

Agent on Order

## METHOD

Extend the weights by their rates—

$$3480 \times @ 21 \text{ cents per cwt.} = \$7.31$$

Use the Fixed Decimal and hold the rate for Key Factor. Note that 4 is the unit figure of the hundredweight; therefore, move to the left one place. Then multiply 3, 4, and 8, moving toward the right. Make all other extensions in the same manner and total the items = \$9.01.

When several items belong to the same class, add the weights for each class before extending, as—

2nd class

265
525
64
<hr/> 854

EXAMPLE: 74,600# Coal @ \$1.70 per Net Ton, 2000#

## METHOD

Use the Fixed Decimal. Hold one-half of the rate for Key Factor and multiply the weight,  $.85 \times 74600 = \$63.41$ , or—

Hold the rate for Key Factor and multiply one-half the weight, (Divide by 2 while multiplying from the left),  $1.70 \times 37.300 = \$63.41$ .

Dividing the "Net Ton Rate" by 2 gives the rate per 1000 lbs., or dividing the weight by 2000, i. e., pointing off three places and dividing by 2, equals the Net Tons and Decimals.

# LOCAL FREIGHT OFFICES—Continued

## GROSS TONS

(1 Gross Ton = 2240 lbs.)

### EXAMPLE:

75,800# Steel @ \$1.40 Gross Ton

#### METHOD No. 1

Weight × Rate	75800 × 1.40
<u>2240</u>	<u>2240</u>

Hold the rate for Key Factor at the right of Keyboard and multiply the weight.... 1061200  
Divide this result by 2240..... \$47.38

#### METHOD No. 2

The Gross and Sand Ton work in the Local Freight is greatly facilitated by using the Reciprocals for 2240 and 2268, and the Fixed Decimal method.

The Amount of Freight is determined by two multiplications without clearing:—

The Reciprocal of 2240 is .00044643.

To facilitate the Fixed Decimal work, cancel out the 3 ciphers, using it as .44643 and point off 3 places in the quantity as 75.800.

Weight × Reciprocal × Rate = Freight.

75.800 × .44643 × 1.40 = Freight.

Multiply weight by Reciprocal over Fixed Decimal.

(Split the Reciprocal 446/43, if using it for Key Factor.)

75.800 × .44643 = 33.83937.

Leave this in the machine and multiply by the rate, 1.40 (3 Factor Way)..... = \$47.38

#### METHOD No. 3

Weight × Rate per 100 lbs. (See "Gross Ton-age Table.") \$1.40 per Gross Ton is equivalent to \$.0625 per 100 lbs. (From "Gross Ton Table.")

75800 × .0625

Hold the rate for Key Factor and multiply, preferably over the Fixed Decimal... \$47.38

## SAND TONS

2268#

Work up in same manner as the Gross Ton. The reciprocal for 2268 being .00044091, use..... 44091

### EXAMPLE:

83460 lbs. Iron Ore @ 1.65 Sand Ton.

#### METHOD

Multiply over the Fixed Decimal 83.460 × .44091, splitting the Key Factor = 36.79835 Ton. Leave this in the machine and multiply by the rate, 1.65, 3 Factor Way = \$60.72.

## PIECE WAY-BILLING

### EXAMPLE:

236 Crates @ \$.576 ea. = \$135.94

#### METHOD

Hold the Rate for Key Factor and multiply over the Fixed Decimal..... = \$135.94

## MINIMUM CAR LOAD BILLING

### EXAMPLE:

45700# Lumber at 13.50 for 24000#.

Hold the Rate, 13.50, for Key Factor. Multiply the actual weight from right of Keyboard = 61,695,000. Leave this in the machine and divide by 24000 = \$25.71, or multiply by the reciprocal, 4167. (See "Reciprocal," for pointing off).

## CORRECTIONS DESK

### COMPTOMETER WORK:

Prove the extensions and additions on the Correction Notices. Abstract the under or over charges to a Report, and add and balance.

## WAY-BILLING

When the S. O.'s are extended and footed, they are turned over to a copyist (as a rule, a typist) who transfers the data to the Way-Bills.

All Blanket Way-Bills are footed by the Comptometer Clerks as soon as copied by the typist. A Blanket Way-Bill is one containing the data for two or more shipments to a station.

FORM A F A. 2-A  
**LOCAL WAY-BILL.**

**NEW YORK CENTRAL & HUDSON RIVER R. R. CO.**

FROM **Daly** STATION STATE TO **Oray, N.Y.** STATE DATE **7-1-1913** WAY-BILL No. **72**

WEIGH THIS CAR AT STOP THIS CAR AT

WHEN A THROUGH RATE IS USED AND THE SHIPMENT IS TO BE RE-BILLED EN ROUTE, THE SUBSTANCES MUST BE SHOWN IN THE DATE COLUMN IN ROAD ORDER NOTING OPPOSITE EACH PROPORTION THE INITIAL OF THE ROAD TO WHICH IT ACCUMES

CONSIGNEE (SHOW NAME IN FULL) CONNECTION LINE IS BY PERCENT ORIGINAL CAR, WAY-BILL NUMBER AND POINT OF SHIPMENT SHOW REFERENCE TO ORIGINAL BILLING FOR FREIGHT RE-BILLED

CONSIGNEE (SHOW NAME IN FULL) CONNECTION LINE IS BY PERCENT ORIGINAL CAR, WAY-BILL NUMBER AND POINT OF SHIPMENT SHOW REFERENCE TO ORIGINAL BILLING FOR FREIGHT RE-BILLED	MARKS CONSIGNEE AND DESTINATION	NO. OF PILES	ARTICLES	WEIGHT	RATE AND AUTHORITY	FREIGHT CHARGES	ADVANCES IN DETAIL	PREPAID
John Doe	E. J. Fisher, 107 Peach St.		Shoes	710	78	5.54 ✓		
" "	F. E. Fell Co.		"	400	21	1.01 ✓		1.01
J. E. Smith	H. P. Adams		Spikes	575	46	1.75 ✓	50	
" "	J. E. Jones		Timber	45	31 M	.31 ✓	31	
" "	P. T. Brown		Hardware	610	37	2.26 ✓		
				2240 ✓		10 85 ✓	81 ✓	1.01

GOOD TARE AND NET WEIGHT OF CAR LOAD FREIGHT TO BE ENTERED IN THIS SPACE

GROSS TARE NET WEIGHED AT

CAR No. **106** TRANSFERRED INTO INT **NO** AT

(CAND WAY-BILLS: FOR SCALE WEIGHT FOR CLASS SHIPPED REBILLED EN ROUTE)

## METHOD

Figure the freight for each shipment. Hold the rate, 78c, over the Fixed Decimal and multiply the weight, 710 lbs., = \$5.54. Follow the same method for each item. Then, add the "Weights," "Charges," "Advances," and "Prepays," for totals.

## LOCAL REVISION

Some roads have installed the system of revising or auditing their Way-Bills at the forwarding office.

The rates are verified and the figure work is proven, at the time the goods are shipped. The S. O., therefore, must correspond with the Way-Bill.

This means clear billing; i. e., proven accuracy at the time of shipment. A further advantage is—it eliminates this work at the General Office and also eliminates all of the changes on reports, which would otherwise occupy the time of a number of clerks in making the necessary corrections.

# DAILY REPORT, OR ABSTRACTS OF "FORWARDED" WAY BILLS

"Forwarded Reports" are merely abstracts of Way Bills, i. e., the "Outbound Local" and "Interline." They show the destination, Way Bill Number, Commodity, Weight, Freight Charges, Advances and Prepaid.

The "Received Reports" contain the same information relative to the "Inbound" Way Bills as the "Forwarded" to the "Outbound."

These reports are written up either by typist or by hand.

## COMPTOMETER WORK

Add the weights,  
1620, 780, etc. . . . . = 299,750

Add the charges, Advances  
and Prepaids.

Each Abstract will contain  
about 40 items.

The average station will  
have from 10 to 60 Abstracts  
daily.

Draw off the totals of each  
Abstract to a Recap. and add  
the Recap.

Draw off the Days totals  
from Recap. to Summary.

The original of this Daily  
Report is forwarded to the  
General Office, daily, for ver-  
ification and use in compiling  
the Monthly balance.

	2175	264	270	
	6740	761		761
	9000	1728		
	76400	7520		
	87100	8470		
	65700	51120		
	49000	3998		
711				
	299750	30867	707	1257


## SUMMARY OF DAILY ABSTRACTS

At the close of each month's business, the Summaries of both the "Forwarded" and "Received" Abstracts are completed.

The Daily Totals are entered on the "Summary" from the Recap. of Abstracts.

C. H. FORM 208 2-12-12 1MM R. I. C. & Co.

## CENTRAL RAILWAY CLEARING HOUSE



*NYC & HP* R. R. 127 Auburn - 4 STATION.

**SUMMARY OF DAILY ABSTRACTS OF WAY-BILLS FORWARDED**

MONTH OF *February* 191*2*

DATE	WEIGHT	FREIGHT	ADVANCES	PREPAID
1	207892	23900		
2	38989	5927	60	
3				
4	65855	11764		
5				
6	75904	7391		
7	1585	506	24	
8	45296	4996		7901
9	10180	2144	165	40901
10	102450	9954		22284
11				
12	48037	5369		8058
13	36591	3757		6586
14	40696	4487	113	7008
	<b>952142</b>	<b>102720</b>	<b>3.13</b>	<b>37038</b>
<b>TOTAL</b>	<b>1625067</b>	<b>182915</b>	<b>723</b>	<b>123776</b>

## COMPTOMETER WORK

Add the "Summary Sheet" about the 25th of the month and jot down the totals in pencil. Complete the adding of the "Summary Sheets" at the end of the month. This method leaves only a few items to add at the time when the work is the heaviest.

Other Abstracts such as—"Interline Forwarded Abstracts," "Interline Received Abstracts," "Connecting Line Reports," etc., have the same information to be added.

# DAILY REPORT, OR ABSTRACTS OF "RECEIVED" WAY-BILLS

"Received Reports" contain the same information relating to the "Inbound" Way-Bills as the "Forwarded Reports" to the "Outbound."

TOTALS	87	754	✓	133	89	✓	36	20	✓	26	84	✓
by the waybills	John Jones											
by me.												
	Agent											

## COMPTOMETER WORK

Add all Weights, Freight Charges, Advances and Prepaids.

Balance the "Received" against the "Bill Register."

When the "Daily Abstracts" are added, draw off to a Recap. Add the Recap. and enter the Day's total on the "Summary Sheet."

## "RECEIVED" FREIGHT BILL REGISTER

The Register illustrated contains the detail records of each Freight Bill issued, and is the medium through which all Cashier problems are settled. Some Registers have columns for entering collections and totaling weekly.

The Freight or Expense Bill is a copy of shipments made from the Way-Bills. The Cashier receives and files one copy, while another goes to the consignee, notifying him of the arrival of freight.

BILL REGISTER										HUDSON			
NEW YORK CENTRAL AND										At <u>Buffalo</u>			
19										Record of Way-B			
WAY-BILL CHARGES										CASH RECEIVED			
Pro. Number	Weight	Local	Advances	PREPAID		Collect	Under Charge	Over Charge	Date Paid	WEEK 1st to 7th.		WEEK 7th to 14th.	
				Local	Beyond					Dr.	Cr.	Dr.	Cr.
376	17160	4960				4960			68		4960		
1	490	200	170			370			44		370		
2	360	185				185							185
3	4175	2160				2160					2160		
4	289	165	235			400	140						240
5	700	173				173					173		
6	340	290				290							290
7	3160	1120				1120		100					
8	9160	500	214			714							714
9	390	312				312							312
10	580	120				365							365
11	740	175				175							175
12	100	128				128							128
13	740	425				425							
14	870	500				760					760		
37,254		119,13	11,24			130,37	140	100			103,66		27,09

Comptometer Work—See following page.



# **"RECEIVED" FREIGHT BILL REGISTER—Continued**

## **METHOD**

With the Comptometer right beside the "Bill Register," add the column of "Weights,"=17160, 490, 360, etc.=37254.

Then add the columns of "Local," "Advances," "Prepaid," "Collect," "Under and Over Charges," the "Cash Receipts," etc. Each page is self-balancing.

Add the **totals** of "Locals," "Advances" and "Prepays"—

119.13	
11.24=\$130.37, and balance against the	
"Collect," \$130.37.	
To the total "Collect," . . . .	130.37
Add the "Under Charges"	1.40
	<u>131.77</u>
and deduct the "Over-	
charges," . . . . .	1.00
	<u>130.77</u>
and balance against the "Cash Received," 1st to 7th—	103.68
	7th to 14th— 27.09
	<u>130.77</u>

Other Bill Registers do not make provision for the weekly record of collections, the items being merely stamped "Paid."

The total of the "Uncollected Bills" is quickly determined by adding on the Comptometer the unstamped items. This will cover a number of sheets, so jot an occasional **running sub-total** on a slip, drop it into the Bill Register at that point. This **makes proof direct from the original items** very simple and easy.

## MONTHLY BASIS

Requires— A Forwarded Bill Register;  
A Received Bill Register;  
A Monthly Forwarded Abstract Sheet for Each Station;  
A Monthly Summary.

The "Bill Register" is practically the same as on Daily Basis system.

The "Forwarded" Way-Bills are recorded daily in a "Forwarded" Bill Register.

## COMPTOMETER WORK

Add and prove the Weight, Freight Charges, Advances and Prepaid.

Post each Daily Total to a Summary Sheet and add at the end of the month.

The "Received" Bill Register is handled in the same manner.

## MONTHLY ABSTRACT SHEETS

These are made up between each Forwarding and Receiving Station, i. e., all Way-Bills from Chicago to Buffalo are recorded on one "Forwarded" Abstract; Way-Bills from Chicago to Cleveland on another, etc. All Way-Bills received at Chicago from Buffalo are recorded on its "Received" Abstract; therefore each Local will have as many "Forwarded Abstracts" as there are stations to which it ships freight, and as many "Received Abstracts" as there are stations from which it receives goods during the month. A Local may have several hundred Abstracts each month.

## COMPTOMETER WORK

About the 25th of the month, add the Weight, Freight Charges, Advances and Prepaid and pencil in the totals. Complete the additions at the end of the month; then, recap. to a "Received" and "Forwarded" Summary, shown on following page.

FORM 484 100% 10

## MICHIGAN CENTRAL

### Monthly Abstract of Local Way-Bills FORWARDED

NOTE A.—WRITE IN THE NAME OF STATION BILL IS GOING TO UNDER WEIGHT AND M. C. COLUMN.  
NOTE B.—DRAW A LINE UNDER WEIGHT, M. C. CHARGES, ADVANCES AND PREPAID COLUMNS AND ADD TOTALS AND THUS SHOW TOTALS FOR EACH STATION. LEAVE TWO OR MORE LINES BETWEEN EACH STATION.

WAY-BILL		WEIGHT	M. C. CHARGES	ADVANCES	PREPAID
DATE	No.				
9/16	4960	5700	1363		650
	73	280	78		
	84	5760	1467		745
	91	14000	1289		
	93	6750	975	400	
	95	210	67		
	96	300	187		100
	97	1600	390		
	5001	280	745		350
	12	740	1157	175	
	13	1725	393		
		<b>37345</b>	<b>8071</b>	<b>575</b>	<b>1845</b>

# MONTHLY SUMMARY OF LOCAL FREIGHT ACCOUNTS

The weight and the charges for all shipments to and from each station are abstracted to this summary sheet. Here they are totaled and proven and then forwarded to the Auditor of Freight Accounts.

MONTHLY SUMMARY OF LOCAL FREIGHT ACCOUNTS.										
NOTE—This sheet is to be detached and sent to the Auditor Freight Accounts. All the sheets for the month's business should be sent together, there being thirteen (13) sheets in all.										
CHICAGO & NORTH WESTERN RAILWAY COMPANY. CHICAGO										
RECEIVED					FORWARDED					
Weight	Freight Charges	Advances			Weight	Freight Charges	Advances	Prepaid		
171460	131716	1867	2185	1 Vandyna	184490	160824	1725	4678		
189320	131895	1768	2375	2 Oakbrook	94680	131875	4746	3247		
94220	67846	913	1145	3 State Hospital	146740	109643	8654	1923		
193740	148656	1846	2676	4 Neenah-Menasha	176430	116447	6427	1736		
74630	17653	1175	745	5 Appleton Jct.	189640	98327	9864	1478		
98750	68347	925	1840	6 Appleton	146780	87463	12135	1945		
154780	123429	1476	2500	7 Little Chute	134960	94712	11463	8675		
134260	118945	1863	1755	8 Wrightstown	178460	108976	9746	1346		
84680	16246	1093	1065	9 Little Rapids	198340	113468	14857	4796		
173250	124638	1856	1137	0 De Pere	47960	67488	17828	1876		
201480	150091	1821	2624	1 Green Bay Jct.	187960	159680	9846	1434		
190360	146201	1803	2595	2 Green Bay	194320	147683	7349	1778		
180460	136941	1763	2037	3 Zachow	81990	76845	7986	1913		
84680	56347	817	1043	4 Bonduel	73540	64983	18146	1462		
191720	139804	1476	1845	5 Lyndhurst	148770	76435	13478	1850		
201620	164764	1898	1762	6 Bowler	139540	59672	19463	2301		
3,664,890	29,648.37	219.68	325.45		2,147,690	12,346.78	904.76	217.55		
5984860	4708966	45178	61224		4473470	2909194	269184	64191		

## COMPTOMETER WORK

Add and prove each column of Weight, Freight, Advances and Prepaid.

Add the totals of the Received to a Grand Total.

Add the totals of the Forwarded to a Grand Total, and prove against the "Bill Register."

## REVISING WAY-BILLS

It is customary for Railroads to hold the "Receiving Agent" responsible for the accuracy of all "Received" Way-Bills; hence the Revising Desk is one of the most important Bureaus to the Local Agent and the place where he appreciates most the accuracy and speed afforded by the Comptometer.

### INBOUND WAY-BILLS

Upon receipt of the In-bound Way-Bill, inspect and revise the Rates; refigure the extensions; and prove the additions.

### BLANKET WAY-BILLS

Accumulate these extensions over the Fixed Decimal, and arrive at the total of the Way-Bill in one continuous operation.

#### EXAMPLE:

A Way-Bill by the cwt. rates.

480 lbs. @ .26 =	
174 lbs. @ .27 =	Accumulate over Fixed
125 lbs. @ .82 =	Decimal. Hold the Rate
125 lbs. @ 1.09 =	for the Key Factor.
740 lbs. @ .864 =	

10.50, the result agrees with the total of Way-Bill.

### INDIVIDUAL WAY-BILLS

Extend each item over Fixed Decimal as illustrated under Shipping Order.

#### EXAMPLE:

4570 lbs. @ .26 per cwt.	= 11.88
31460 " @ .72 " "	= 226.51
48400 " @ 2.10 per Net Ton.	= 50.82
74800 " @ 1.65 " Gross Ton.	= 55.10
74500 " @ .85 " Sand Ton.	= 27.92

### PRORATING ON THROUGH RATE

#### EXAMPLE:

46700 lbs. @ .46 per cwt.	= 214.82
Say this shipment travels over three Roads.	
A's Proportion is .082 per cwt.	= \$ 38.29
B's " " .161 " "	= 75.19
C's " " .217 " "	= 101.34
	<hr/>
	.460 \$214.82

Hold the Rate, .082, for Key Factor over Fixed Decimal, and multiply the pounds, 46,700, = \$38.29. Add these results to prove against the Total.

### PRORATING BY PERCENTAGES

#### EXAMPLE:

8450 lbs. @ .92 per cwt.	= 77.74
The percent for Road A is 41.6% of 77.74	= 32.34
" " " " B " 15.0% " "	= 11.66
" " " " C " 43.4% " "	= 33.74
	<hr/>
	100.0 77.74

Hold the percentages for Key Factors over Fixed Decimal and multiply freight charges 77.74. Add the prorated items and prove against the total freight.

### PRORATING WHERE THERE IS AN ARBITRARY AMOUNT TO DEDUCT

#### EXAMPLE:

7175 lbs. @ .45 per cwt. = 32.29  
 Prorate giving Road A 35% plus on arbitrary of .03 cts. a cwt. for a Bridge charge, and Road B 65%.

# REVISING WAY-BILLS—Continued

## METHOD

Multiply the weight 7175 by  
 Arbitrary .03c over the  
 Fixed Decimal..... = 2.15  
 Clear the machine and add  
 in the Freight Charges... = 32.29  
 and Deduct the Arbitrary  
 before prorating..... = 2.15  
   30.14  
 Leave this in the machine  
 and multiply by 35% equals  
 (Three Factor Way) = 10.55  
 Add to this the amount of  
 Arbitrary..... = 2.15  
   = 12.70 For Road A.  
 Clear and multiply 30.14 by  
 65% ..... = 19.59 For Road B.  
 Add to this, the amount for  
 Road A..... = 12.70  
 Total Freight..... = 32.29, as proof.

## LOCAL AUDITING

Several roads have installed "Local Auditing Bureaus" at the large cities and at junction points. They audit and prove the Way-Bills at the time issued, thus making corrections for under or over charges at the initial steps of the transaction. This eliminates much work in the General Office.

## RE-CONSIGNING OR DIVERTING FREIGHT

Many shipments are stopped in transit and re-shipped to places other than originally intended.

## METHOD

Re-bill and re-figure at the new rates. Where required, prorate the earnings on percentage or mileage basis for the carrying roads.

## CASHIER'S RECORD OF FREIGHT BILLS COLLECTED

The Cashier enters on this form the payment of each individual Freight Bill, giving the name of Consignee, the number of Way-Bill, "Freight" and "Daily Total" for each consignee.

The payment of each Freight Bill is entered separately, and, at the end of the day, the Agent adds each column and balances against the "Cash Received."

A. D. 34329

1910 R. 34-35-36  
10 x 12

Agent's Record of Freight Bills Collected									
DATE	NAME	BILL NUMBER	FREIGHT						DAILY TOTALS
7/19	J. B. Hart	2467-28	490	525					10 15
	Ed. Hansen	2467-29	375	468	525				13 68
	Frederick Hamrell	2467-30	394	21 67					25 61
	W. C. Humphrey	2467-28	18 48	16 79					35 27
	L. A. Amundson	2465-67	521	30 78					35 99
	M. A. Whipple	2467	590						5 90
	C. Blake	2467	17 28						17 28
			4653	32 27	4 16				82 96
			10599	111 44	19 41				226 84

## "CUSTOMER'S COMBINATION BILL AND CARD LEDGER"

Most large shippers are given authorized credits; i. e., allowed to make settlements weekly. This "Combination Bill and Charge Ledger" is a simple form, with carbon copy on cardboard, of the "Freight Bill," "Number," "Amount" and "Corrections." The Cashier makes these entries at the time the freight is delivered and can handle the forms very rapidly.

## COMPTOMETER WORK

At the end of the credit period. Place these forms right beside the Comptometer. Add the amounts of "Freight." Make any additions or deductions for corrections.

This simple scheme for recording the customers' bills, the duplicate forming the "Card Ledger," simplifies the work of handling the "Customers' Authorized Credits." The original on thin paper is detached and mailed to the customer as his statement of Freight Due. The Cashier stamps the Card Ledger Form as being "Paid" when he receives check from the customer.

### STATION BALANCE SHEET

The "Station Balance Sheet" is a statement showing Daily Totals of all charges for Freight Received, etc., and a summary of all uncollected accounts.

The classified amounts are posted to this "Balance Sheet" daily.

STATION BALANCE SHEET

5

1  
1  
1  
1

1

1  
1

### METHOD

With the Comptometer right beside the "Balance Sheet," add daily for the current day's totals. At the end of the period of one or two weeks, or a month, as the case may be, balance for the period, i. e., cross-add the classified daily amounts 1437.40 1621.60, etc. = 7897.14.

Cross-add the "Totals," 1916.41, 2093.40, etc. = 10642.38, proving against the footing of "Totals" Column.

The total of Credits must balance against the total of Debits.

## CORRECTION REPORTS

The Larger Local Freights will usually send in a number of correction statements, containing records of all adjustments made by the Local Agent. They contain the amounts "as billed," "as corrected," and the under-charges or the over-charges.

MICHIGAN CENTRAL RAILROAD CO.											
AUDITOR FREIGHT ACCOUNTS.											
CORRECTION STATEMENT.											
Buffalo, N.Y. Station, for month ending July											
AS BILLED			AS CORRECTED			UNDERCHARGE - Dr.			OVERCHARGE - Cr.		
Weight	Rate	Charges	Weight	Rate	Charges	M. C. R. R.	Other Roads	TOTAL	M. C. R. R.	Other Roads	TOTAL
3670	18	661	3670	21	771			110			
780	28	207	780	28	218			11			
1163	78	913	1163	64	750						163
30000		16540	30000		18520			2320			340
4870	31	1510	3790	31	1175						335
4044		19831	39403		21434			2441			838

## COMPTOMETER WORK

Verify the "as corrected" extensions.

Hold the rates for Key Factor and multiply over the Fixed Decimal.

3670 lb @ 21c cwt. .... = \$7.71

780 lb @ 28c cwt. .... = 2.18

Continuing for all corrections in this manner.

Add the amounts "as billed," 6.61, 2.07, etc. .... = \$198.31

Add the Under-charges, 1.10, .11, etc. = 24.41

Leave this in the register and add to it the total "as billed" .... 198.31

Jot this result (222.72) on a pad .... \$222.72

Add the "corrected" and over-charges in the same manner equals: 214.34 and 8.38. Add these to a total = 222.72, proving against the sum of the "billed and over-charge."

## SUMMARIES

Add all columns of Weights, Freight, Advances, and Prepaid on the Summaries of all "Received, Local and Interline Reports."

For Summaries, see "Local Freight."



## PAYROLL ON THE TONNAGE BASIS

The prevailing method for paying freight handlers has been the Daily or Hourly Basis. Recently some roads have adopted the method of paying their men for the **number of tons handled**.

### ADVANTAGES CLAIMED

Increased tonnage handled per man.  
Increased wages, commanding better class of labor.  
Freight handled more expeditiously.  
Underweights eliminated; thus increasing the revenue.

The Freight Handlers are usually divided into gangs of seven men, consisting of five truckers, one tally-man, and one caller.

When loading or unloading Freight, they stamp their gang number on the Way-Bill, Shipping Order, or Check-Out Slip.

### COMPTOMETER WORK

Add and prove the weights according to the gang number, **direct from the Way-Bills, Shipping Orders, or Check-Out Slips**. Divide the total by the number of truckers and post the amount to the Payroll Book.

### EXAMPLE:

Caller and Truckers rate say is 11c per ton.  
Tally-men rate, 14c per ton.  
Gang A handled 253 S. O.'s  
and 231 W. B.'s

### METHOD

Add the weights direct from the S. O.'s. Drop in an occasional sub-total slip.

Total weight of S. O.'s is say . . . . 109570 lbs.

Total weight of W. B.'s is say . . . . 86490 lbs.

Total weight handled . . . . . 196060 lbs.

### Find the Tons Handled.

Leave the pounds in the machine.  
Reduce the pounds to Tons; point off four places and multiply by 5, the reciprocal for 2000 . . . . . = 98.03 Tons handled by "Gang A."

### Find the Tons per trucker —

Divide this "Gang A Total"  
98.03 tons by 5 . . . . . = 19.606 Tons averaged per trucker.

Or better multiply by the reciprocal, 2.

The Tons being in the machine once, merely add the same amount over itself and point off one place = 19.606

Clear and multiply the Tons handled per man by the Rate,  
 $19.606 \times .11$  . . . . . = 2.16, for each trucker and checker in "Gang A."

$19.606 \times .14$  . . . . . = 2.74, for the Tally-man in "Gang A."

Post each amount to a Payroll Book and add at end of Pay Period.

## AUDITOR OF FREIGHT ACCOUNTS

This office audits all Freight Traffic Accounts, compiles the data and works up statistics relative to same.

The systems or methods employed in Auditing and working up the data vary so much in the different railroad offices that we will outline only the basic features of the work.

The principal uses for Comptometer are on:

Verifying Forwarded Reports  
Verifying Received Reports and  
auditing against corresponding Way-  
Bills. { Correction  
Statements  
Interline  
Local

Verifying Summaries.

Way-Bill Revision.

Compiling Interline.

Estimated Earnings, Com-  
modity Statistics, and Division  
or State Earnings.

Average Percentages on Earn-  
ings, etc.

Making up General Balance.

Figuring Division Earnings.

Figuring State and Interstate  
Earnings and Percentages.

Daily Forwarded Reports  
(see Local Freight).

The Forwarded Reports and  
the abstracts are received from  
the Local Agents daily.

## DAILY RECEIVED REPORT

The "Received Way-Bills" are attached to the reports and forwarded to the Auditor of Freight Accounts by the Local Agent. One report is received from each Agent.

## COMPTOMETER WORK

Add the Columns of Weights, Freight Charges, Advances and Prepays, for verifying the Agent's Totals.

WAYBILL		FROM	TO	WEIGHT	WEIGHT	POUNDS	FREIGHT CHARGES	ADVANCES	PREPAID	L. or F.	FREIGHT BILL NUMBER
Number	Date										
3127	13	Scranton	N	26	16700	1265					101
3168	14	Long Hill	N	27	8740	967					102
43169	13	Montrose	N	26	370	165					103
13170	13	Fern Glen		26	490	370					104
73174	12	Danville		26	500	450	145				105
3472	13	Rockledge		26	1670	1645			1645		106
3676	14	Buffalo	6	26	18740	3760					107
						349600	38680	3254	558.00		
						TOTALS	396810	47502	3399	57445	

I certify that all the calculations on the waybills covered by this report have been verified by me. *Sam. Smith* Agent

## METHOD

With the "Way-Bills" and "Report" right beside the Comptometer, add the Charges direct from the "Way-Bills" and balance the totals against the "Received" Reports. This will eliminate the comparing and checking off of the individual items. The "Way-Bills" are then assorted to "Forwarding Station Order"; i. e., all "Way-Bills" received by Chicago, South Bend, Hammond, etc., from Omaha are assorted under Omaha and each amount for "Way-Bills" compared with and checked against the Omaha "Forwarded Report."

# WAY-BILL REVISION

Most Railroads revise all "Way-Bills," either at the General Offices or at Division Accounting Offices. There are thousands of "Way-Bills," both Local and Interline, to be proven and corrected daily. As a rule no correction will be made for less than 2 cents.

The following illustrates a portion of tissue copy of Blanket Way-Bill. The Comptometer work consists in proving the extensions and additions. Where Blanket Way-Bills of several items to a Way-Bill, the best method of proof is by accumulation.

CONSIGNEE	COMMODITIES	ARTICLES & QUANTITIES	NET WT	PER CWT	FREIGHT	ADVANCES	PER PAGE
Chen & Lang	W. Lewis & Co.	1 cse clothing	120	70	84		
Hy. Meide	L. A. Kresge & Co.	1 cse Candy <sup>6028</sup>	166	51	85		
Alumina Mfg. Co.	Warwick Bros	1 cse paper bags	60	m	70		
Stanhams & Smith	Bedgeman & Co.	1 cse goods <sup>7191</sup>	270	70	189		
C. H. Bentley & Co.	O. M. Smith & Co.	1 cse goods	69	m	70		
Stanhams & Smith	Bedgeman & Co.	1 cse goods <sup>74059</sup>	110	70	77		
A. B. Coffin Co.	John Gillman	1 cse goods	260	70	182		
Lustig Bros.	Crawford & Zimmerman	1 cse bags <sup>8251</sup>	50	m	70		
cd Detroit.			1055		799		
					792		

## COMPTOMETER METHOD

Add the weights 120, 166, etc., for proof.

Hold the rates for Key Factors over the Fixed Decimal, and multiply the weights, accumulating, to the total,

$$1.20 \times .70$$

$$1.66 \times .51$$

Add .70. This being a minimum charge, simply add the 70c, continuing to the total = \$7.92.

This accumulation is 5c less than the original total; therefore, locate the error by re-figuring each item separately,

$$1.20 \times .70 = 84, \text{ correct.}$$

$$1.66 \times .51 = 85c, \text{ against the original, } 90c.$$

This difference, 5c, is the same as between the totals; therefore, make corrections to correspond, i. e.,

\$ .85 for the extension and \$7.92 for the total.

A correction slip is then made out for further use in making up "Correction Sheets."

The revision work will include, figuring by cwt., the Net Ton, Gross Ton, Sand Ton, Baskets, Crates, etc. (See Local Freight work for illustration.)

## COMPTOMETER METHOD OF WORKING UP DIVISION EARNINGS

D I S T R I B U T I O N   O F   D I V I S I O N   E A R N I N G S .										
STATIONS	AMOUNT		A %	B %	C %	D %	E %	Division Distribution.		
St. Joseph	43	50	16	27			57	A	55	86
San Francisco	16	42	18	32			50	B	121	05
Reading	76	48	24	17	13	46		C	55	13
Colorado Springs	13	24	32	16	28	24		D	67	83
Boston	163	75	14	29		18	39	E	125	15
Sioux City	48	76		26	16		58			
Topeka	54	32		38	62					
Omaha	8	55	5	95						
Total	425	02							425	02

With the Comptometer, the above distribution of Division Earnings is made and proven in three minutes and the only figures necessary are in writing down the amounts of distributions.

## COMPTOMETER METHOD

The Divisional percents are first applied, then—

The Comptometer is placed right beside the Division Sheet and extends, accumulatively, each amount by its respective percent for one Division, i. e.,—

\$43.50 by 16%

16.42 by 18%

76.48 by 24%, etc., = \$55.86 accruing to Division "A."

Work up the distribution for each Division in the same manner.

Add the Divisional distributions, \$55.86, 121.05, etc., = \$425.02, proving against the total of amounts distributed.

In this manner, the total earnings proportioned against each Division is determined in one continuous operation, and without making a figure.

## ILLUSTRATION OF THE OLD HAND METHOD OF WORKING UP DIVISION EARNINGS

DISTRIBUTION OF DIVISION EARNINGS												
STATIONS	A		B		C		D		E			
	Amount	%	Amt	%	Amt	%	Amt	%	Amt	%		
St. Joseph	43 50	16	6 95	27	11 75						57	24 80
San Francisco	16 42	18	2 96	32	5 25						50	8 21
Reading	76 48	24	18 36	17	13 00	13	9 94	46	35 18			
Colorado Springs	13 24	32	4 23	16	2 12	28	3 71	24	3 18			
Boston	163 75	14	22 93	29	47 49			18	29 47	39	63 86	
Sioux City	48 76			26	12 68	16	7 80			5	28 25	
Topeka	54 32			38	20 64	62	33 68					
Omaha	8 55	5	43 95		8 12							
Total.	425 02		55 86		121 05		55 13		67 83		125 15	

4350	16	1642	76 48	13 24	163 75	48 76	54 32					
26100	16	13236	30592	2648	65500	29256	4856	855				
4350	1642	1642	183552	3972	16375	9752	16296	5				
69600	29556	29556	7648	42368	229250	126776	206416	4275				
4350	16	42	53336	1324	16375	4876	5432					
27	32	32	7648	7944	147375	4876	5432					
30450	3254	3254	130016	1324	32750	474875	29256	10864				
8700	4722	4722	7648	21184	16375	4876	32592	855				
117450	52504	52504	7648	13	18	78016	336784	4275				
4350	1642	1642	52504	13	18	78016	2064	4695				
57	50	50	82100	22944	131000	4876	5432	81225				
30450	296	296	7648	10592	16375	4876	5432					
21750	522	522	99424	2648	294780	58						
247950	1642	1642	1324	16375	39	24380						
696	45888	45888	5256	147375	282808	5587						
2480	30592	30592	2648	49125	1268	5513						
1174	351808	351808	31776	638625	780	6783						
4350	1300	1300	423	2299	4749	12515						
	994	994	212	2947	16375							
	3838	3838	371									
	7648	7648	1324									

The method of distributing Division Earnings before employing the Comptometer:

Each amount is distributed to its several divisions by figuring the proportion for each division separately, and distributing.

\$43.50—16% is figured and entered for  
 Div. A..... \$6.95  
 27% is figured and entered for  
 Div. B..... 11.75  
 57% is figured and entered for  
 Div. E..... 24.80  
 \$43.50

Then these proportions are added and proved against amount distributed.

More than 600 figures are made. Nearly one half hour of the average clerk's time is consumed.

Compare this with Comptometer Method on opposite page.

**COMPTOMETER BRIDGE**

The Comptometer Bridge is designed to elevate the Comptometer over the sheet, or work in such a manner that the sheet may be moved back and forth in either direction, so as to have the column of figures

in close proximity to the Comptometer. The Bridge shown allows about  $\frac{3}{4}$ " space over the sheets, but, of course, the Bridge can be made any height desired to accommodate the work in hand.

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**COMPTOMETER SWIVEL BRACKET ON DESK OVER A DIVISION DISTRIBUTION SHEET**

The Swivel, or Holder, supports the Comptometer about an inch above the desk, which allows the work sheet to be moved back and forth in order to have the work close to the machine. It also allows the Comptometer to be used at any angle suiting the position of the operator, and, when not in use, to be swung back out of the way.

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## COMPILING INTERLINE

The "Interline" includes the data regarding all shipments over two or more roads.

### DETAIL MONTHLY INTERLINE REPORT

The Monthly Interline Report is a "station to station" balance, covering shipments over a home road and one or more connecting roads. There will be as many Interline Reports from each station as there are stations and roads from which it has received freight.

COPY INK. Form 111. 25th. 1 y. (W&A 100-0)

## The Lake Erie & Western Railroad Company.

THE NORTHERN OHIO RAILWAY COMPANY

MONTHLY REPORT OF INTERLINE AUDIT OFFICE SETTLEMENT WAY-BILLS.

Received at Sandusky Station, Month of July 1910

via St. Louis JUNCTIONS Station and St. Louis I. & N. R. R.

via Tex. Station and T & P. R. R.

From St. Louis Station and St. Louis I. & N. R. R.

via Tex. Station and T & P. R. R.

via St. Louis Station and St. Louis I. & N. R. R.

via St. Louis Station and St. Louis I. & N. R. R.

Via Fast Freight Line Station, Junction with L. E. & W. System.

*Handwritten:* L.E. W. 26.4% = 597.01 / 811.15

Way-Bill	Car	Kind of Freight	Weight	Freight	Advances	Prepaid
Date	Number	Initial	Number			
			From <u>Dallas, Texas</u>			
7/6/10	31	T & P	3167	Mis.	18 460	41 60
"	39	"	3168	"	19 460	31 80
7/8/10	46	I & N	67	Stock	28 740	68 75
7/9/	192	M. P.	316	Coal	94 700	146 75
7/12	467	"	764	"	74 120	96 70
7/13	468	"	765	"	75 700	99 80
					245 560	325 75
					556 740	811 15

Data Wanted: Totals of Weight, Freight, Advances and Prepaid, and proportions accruing to each Road.

### METHOD

The Totals:

Add and prove the Weight, Freight, Advances and Prepaid.

Prorate the "Freight" on Authorized Percentages.

Hold the Percent, 26.4% for Key  
Factor at the right of Keyboard and  
multiply the Freight, \$811.15..... = \$214.14

Clear and multiply Freight, \$811.15,  
by the Lake Shore Percent, 73.6%..... = 597.01  
Leave this in the register and add the  
first proration for proof against the total.. 214.14

\$811.15

Prorate in this manner all Interline sheets and  
transfer to a "Road Summary."



# COMPILING INTERLINE—Continued

Form 768 3-23 39M C-11 wa-

LAKE ERIE & WESTERN RAILROAD COMPANY

ACCOUNTING DEPARTMENT—Office of Auditor Freight Accounts

ROAD SUMMARY DIVISION OF REVENUE AS SHOWN ON INTERLINE WAY-BILLS FROM STATIONS ON THE LINE OF

Lake Shore

R. R. MONTH OF July

1910

FROM	TO	VIA	WEIGHT		FREIGHT		ADVANCES		PREPAID		PROPORTIONS					
											Percent	L. E. & W. R. R.		Percent	L. E. R. R.	
Buffalo	Elliott.	Sandusky	556	740	811	15	21	09	15	60	26.4	214	14	73.6	597	01
"	Gibson.	"		490	1	45	1	60			26.4		38	73.6	1	07
"	Derby.	"	6	940	16	70		75			18.5	3	09	81.5	13	61
"	Deer Creek	"	17	285	20	70		31	14	60	18.5	3	83	81.5	16	87
"	Handy.	"	4	675	5	74	1	64			14.6		84	85.4	4	90
"	Oxford.	"	19	480	46	75	1	74			72.4	33	85	27.6	12	30
"	Clearfield.	"	1	760	9	64		36			72.4	6	98	27.6	2	66
"	Easton.	"		540	2	40	1	90			54.5	1	31	45.5	1	09
"	Philadelphia.	"	60	700	45	75					67.1	30	70	32.9	15	05
			119	030	180	83	14	00	14	60		89	35		91	48
			787	640	1,141	11	43	39	44	60		384	47		756	64

One or more Road Summaries will be required for each Railroad.

A Connecting Line Summary is made up from the Road Summary for each Railroad involved.

## COMPTOMETER WORK

Add and prove the freight,

811.15, 1.45, etc. = \$1,141.11.

Add and prove the Weight, Advances and Prepaid.

Add the proportions to each Road, 214.14, .38, 3.09, etc. = \$384.47.

Prove the sum of the proportions, 384.47, 756.64, against the "Freight."

Interline charges will be divided on several different Bases, including "Arbitraries," "Refrigeration," "Terminal Charges," etc., which make the Comptometer almost indispensable for this work.

## INTERLINE—Continued

## INTERLINE EXAMPLE:

Shipment from San Francisco to Auburn, New York, Via So. Pac., Union Pacific, St. Paul, E. J. & E., Mich. Central & N. Y. Central.  
 41,480 lb @ 75c cwt. = \$311 10  
 Lines east of Chicago receive 25% of total Revenue.  
 The C. M. & St. P. receives 15% of Total Remainder, out pays an Arbitrary to E. J. & E. of \$3.00.  
 The Roads West receive the Balance.

## BASIS OF DIVISION

## Lines East:

Deduct Arbitrary of \$4.00 for the E. J. & E., and Prorate the balance on authorized Percents of 22.7% for N. Y. C. and 77.3% for the Mich. Cent.

## Roads West:

Prorate the balance on Authorized Percents of 46% U. P. and 54% So. P.

CENTRAL RAILWAY CLEARING HOUSE.													
DIVISION STATEMENT													
Divisions of Revenue on Interline Way-Bills Received Account of <u>N.Y.C. &amp; H.R.R.R.</u> R. R. Month of _____													
FROM	TO	Weight	Freight	Advances	Prepaid	East	Roads	Proportions	Proportions	Proportions	Proportions	Proportions	Proportions
San Franc	Auburn N.Y.	41,480	311.10										
	Lines East of Chicago												
	Arbitrary to E. J. & E.		4.00										
	Lines West of Chicago												
	C. M. & St. P.												
	U. P.												
	Balance												

Original Figuring of Interline by Auditing Office of the Receiving Road:

## METHOD

## Lines East:

Hold rate, 25%, for Key Factor and multiply \$311.10. = \$ 77.78  
 Leave this result in the Register and subtract 4 00  
 Amount to be Prorated on N. Y. Cent. and Mich. Cent. = \$73.78  
 Leave in the Register and multiply by the N. Y. Cent. percentage, 22.7% (3 Factor Way) = 16.75  
 Clear and multiply 73.78 by Mich. Cent. %, 77.3% = 57.03  
 Add to this the Arbitrary 4.00  
 And the New York Central Proration 16.75  
 Equals the total for lines East and West and proves the accuracy. = \$ 77.78

## Lines West:

Clear and add in the Register at the right, the total freight 311.10  
 Subtract amount for lines East 77.78  
 Equals = \$233.32

Multiply this, 3 Factor Way, by C. M. & St. P. percentage, 15% = \$35.00  
 Subtract the Arbitrary for E. J. & E. = 3.00  
 Equals amount accruing to C. M. & St. P. = \$32.00  
 Add back the Arbitrary = 3.00  
 = \$35.00  
 and subtract, negatively (see Negative Subtraction) = 233.32  
 Gives a balance to prorate on U. P. & So. P. of = \$198.32  
 (Or Clear and Add in 233.32 and subtract 35.00  
 198.32)  
 Prorate this balance 46% to U. P. Leave the 198.32 in the Register and multiply 3 Factor Way = 91.23  
 Then clear and multiply by 54% for So. P. = 107.09  
 Add all Prorations, 77.78, 35.00, 91.23, 107.09 = \$311.10  
 Which proves against the total, \$311.10.

INTERLINE—Continued

Proving Foregoing Prorations by SO. PACIFIC RAILROAD.

The So. Pac. receives the statement of Prorations showing:

Lines East, 25% N. Y. C..	22.7%	16.75	77.78
M. C....	77.3%	51.03	4.00
E. J. & E. Arb.....	4.00	4.00	73.78
Balance.....		233.32	
C. M. St. P. 15%.....		32.00	
Less Arb. E. J. & E.....		3.00	35.00
Balance.....		198.32	
U. P. 46%.....		91.23	
So. P. 54%.....		107.09	
		311.10	

The So. Pac. is interested only in knowing that it has been allotted the correct amount.

Therefore: Figure the "nets" from each section and arrive directly at the So. Pac. proportion.

Multiply 311.10 by 75%, the net after allowing for lines East..... = 233.32

Leave this in the Register and multiply, 3 Factor Way, by 85%, the net after allowing for C. M. & St. P..... = 198.32

Leave this in the Register and multiply by 54 (3 Factor Way), the percentage for the So. P..... = \$107.09

Which proves against the original proration.

EXAMPLE OF —

Interline with cwt. arbitrary.

31700 lb Omaha to New York @ 78c.. = \$247.26

Prorated on Basis of 3½c cwt. Arby. Bridge charge for U. P.

41.3%	C. M. St. P.
18.5%	Mich. Central.
40.2%	N. Y. Central.

Hold the rate, .035, for Key Factor over Fixed Decimal and multiply the weight, 31700 = \$11.10 U. P. Bridge Charge.

Make a negative subtraction of	247.26
	\$236.16

(Or Clear and add in 247.26 and subtract 11.10.)

Hold the Percentages for Key Factors and Prorate, \$236.16 on Basis of above authorized per cents.

U. P.....	11.10
C. M. & St. P.....	97.53
Mich. Cent. ....	43.69
N. Y. Cent. ..	94.94
	\$247.26

### ESTIMATED EARNINGS

Many Railroads make weekly estimates of earnings for the General Manager's information and financial reports. Some work up these estimated Earnings from the Forwarded Reports, others from the Received Reports.

If Forwarded Reports, add directly on the Comptometer the amount of each forwarded report, jotting an occasional sub-total on a slip and dropping it in the pile of added reports for easy proof. (Or jot an occasional sub-total on the back of a report.)

If Received Reports, add the received reports in like manner.

### COMMODITY STATISTICS

The methods employed and the forms used by the various roads differ widely. In a general way the information is gotten in the following manner:

The goods shipped are segregated into commodities. The commodity segregations of the different roads vary in number from 50 to 80. They are known by numbers as well as names.

The principal statistics wanted are:

#### COMMODITY WEIGHTS AND AMOUNTS BETWEEN STATIONS

The tons and amounts of the various commodities are abstracted to a Commodity Tonnage Book from the Forwarded or Received Reports.

The General Offices have thousands of columns of such additions every month.

#### COMPTOMETER WORK

Add the Weights and Amounts for Each Commodity—

As for grain, 37, 16, 17, etc. = 302.

39.60, 18.70, 19.60, etc. = \$304.60

Find the Ton Miles:

Grain—quantity of grain hauled, 302  
Tons.

Distance, as noted in upper right  
hand corner, 126 Miles.

Hold miles, 126, for Key Factor, at Right of Keyboard, and multiply the Tons, 302 = 38052 Ton Miles.  
Then abstract the totals to Commodity Tonnage and Earning Sheets.

The weight and amount of each commodity shipped between stations, viz.:

Between Chicago and South Bend,

Between Chicago and Erie, etc.

The Tons hauled one mile for each commodity.

The same information for each Division of the Road.

The same information for each State.

## COMMODITY STATISTICS—Continued

## CARLOAD COMMODITIES

Carload shipments of all selected commodities authorized by the Inter-State Commerce Commission are tabulated separately:

The statements show the Through Revenue and  
The percentage accruing to the local road,  
The Weight and the distance hauled.

FORM 103a CAR LOAD shipments of <u>Grain</u> for month of <u>July</u> 191 <u>1</u>									
FROM	TO	Through Revenue	L. E. & W. Percent	L. E. & W. Pay's Revenue	WEIGHT	DISTANCE	TONS 1 MILE		
Buffalo	Erie	814.65	2.14		106,700	67			
Waukegan	St. Louis	78.90	2.14		75,600	67			
Cleveland	Kansas City	167.40	8.42		84,000	166			
Chicago	"	137.90	1.78		54,000	196			
Hampton	"	16.40	4.65		19,000	28			
St. Louis	St. Louis	57.00	7.28		47,000	95			
Rochester	"	47.20	8.16		37,000	106			
		820.45		337.91	423,300		45,577	100	

## COMPTOMETER WORK

Add the items of Revenue, 314.65, 78.90, etc. = \$820.45.

Add the items of Weight, 106,700, 75,600, etc. = 423,300 lbs.

Figure the "Home Road" proportion of Revenue for the Commodity, accumulating to the total,

$$\text{i. e., } 314.65 \times .214$$

$$78.90 \times .214$$

$$107.40 \times .842, \text{ etc., equals } \$337.91$$

Figure the Tons One Mile in the same manner, equals 45,577,100 lbs., or 22,788.55 Tons.

# **COMMODITY STATISTICS—Continued** **COMMODITY TONNAGE AND DIVISION AND STATE EARNINGS**

The Commodity Tonnages and Revenues are abstracted from Tonnage and Revenue Book, by station movements.  
 The "Miles hauled" and authorized Divisional and State percentages are applied from a mileage and per cent book to this Commodities, Tonnage and Earnings sheet

STATION FROM		STATION TO	Commodity	WEIGHT	Total Miles	TOTAL TONS ONE MILE	TOTAL REVENUE	Div. 1											
								Miles	Tons One Mile										
Des		attn	Gran	79	294		7186	144		490	34		115	116		395			
NH		"	"	54	289		14599	144		498	34		118	111		384			
Ph		"	"	68.1	264		14066	34		129	115		435	115		436			
Ph		"	"	71	256		12796	116		454	37		144	103		402			
Ph		"	"	92.2	206		19065	78		378			123	123		622			
Ph		"	"	130.5	163		31600	75		460	16		98	72		402			
Ph		"	"	76.4	105		31667			54			514	51		486			
Ph		"	"	183.4	96		96042	37		384	12		125	47		491			
Ph		"	"	16.7	78		37068			38			521	35		479			
Ph		"	"	9.5	28		1698	7		208	21		750			181			
Ph		"	"			121461.2													
Ph		"	"	173	294		116740	144		490	34		115	116		395			
Ph		"	"	186.7	116		59067	16		138	27		319	63		503			
Ph		"	"	195	148		76540			50			338	98		602			
Ph		"	"	781	31		11927	31		1000									
				1339.5		225168.5	532271		73523.7	155475	44251.5		121097	107293		255499			

## COMPTOMETER WORK

Figure the tons one mile

Hold the "Total Miles" for Key Factors and multiply the Tons, accumulating and jot down Running Totals about every 5 to 10 items.

$$7.9 \times 294$$

$$54. \times 289$$

$$68.1 \times 264, \text{ etc.} = 121461.2 \text{ Ton Miles.}$$

And continuing,

$$123. \times 294, \text{ etc.} = 225168.5 \text{ Total Ton Miles.}$$

Figure Divisional and State Tons One Mile per Commodity

The Divisional Mileages are applied from a mileage book.

## COMPTOMETER WORK

Hold the miles for Key Factors and multiply the Tons accumulating to a total, or jot down an occasional Running Sub-total,

$$7.9 \times 144$$

$$54. \times 144$$

$$68.1 \times 34, \text{ etc.} = 73523.7, \text{ Tons one mile for Division 1.}$$

Continue in the same manner for each Road Division or State Tons One Mile.

Add the Tons 7.9, 54., 68.1, etc. = 1339.5.

Cross-add the "Divisional" or "State" Tons One Mile,

73523.7, 44351.5, etc. = 225168.5, proving against the Total Tons One Mile.

Figure Divisional and State Revenue per Commodity

Hold the Percentages for Key Factors at the right of Keyboard and multiply the corresponding Revenue,

$$71.86 \times 49.0\%$$

$$145.99 \times 49.8\%, \text{ etc.}$$

Accumulate and jot down a Running Sub-Total for each 5 to 10 items, equals a total of \$1554.75.

Continue in the same manner for each Division or State Earnings.

Add the Total Revenue, 71.86, 145.99, etc. = 5322.71.

Cross-add the "Divisional or State Revenues."

1554.75, 1210.97, etc. = 5322.71, balancing against the Total Revenue.

## VOLUME OF THIS CLASS OF WORK

Some Railroads will have as many as 60 Road Divisions over which the Revenue and Ton Miles must be distributed.

**STATION STATISTICS**  
**SHOWING TONNAGE AND EXPENSE OF OPERATION**

This comparative statement shows the Increase or Decrease and its percentage, for each item. The entire statement will contain about sixty items.

C. T. 119					
PENNSYLVANIA RAILROAD—Buffalo & Allegheny Valley Division					
Statement Showing Tonnage and Expenses of Operation at <i>Cary</i> Freight Station					
During <i>July</i> 19 <i>13</i> and <i>July</i> 19 <i>12</i>					
	19 <i>13</i>	19 <i>12</i>	INCREASE	DECREASE	%
TOTAL REVENUE OF STATION . . . . .	1,465,289	1,312,460	152,829		11.6
DIVISION OF TONNAGE					
Inbound C. L. (W.-B. Weights) . . . . . Tons	260 000	245,174	14,826		6.0
Outbound C. L. (W.-B. Weights) . . . . . "	216,470	202,180	14,290		7.1
Total C. L. . . . . "	476,470	447,354	29,116		6.5
Inbound L. C. L. (W.-B. Weights) . . . . . "					
Outbound L. C. L. (W.-B. Weights) . . . . . "	416,285	375,193	41,092		11.0
Transferred (W.-B. Weights) . . . . . "	573,840	495,760	78,080		15.7
A Over . . . . . "	104,670	82,120	22,550		27.5
Total L. C. L. . . . . "	1,094,795	953,073	141,722		14.9
Grand Total for Station . . . . .	1,571,265	1,400,427	170,838		12.2
TONNAGE HANDLED					

**EXAMPLE:**

**METHOD**

Add the "Total Revenue," 1913, in the machine . . . . . 1465289.  
 Subtract "Total Revenue," 1912 . . . . . 1312460.  
 Jot down this increase . . . . . 152829.  
 and add back the 1912 Revenue . . . . . 1312460.  
 which proves the subtraction . . . . . 1465289.  
 Figure the percentage of Increase or Decrease to the  
 3d decimal. Therefore use only the first four figures of Divisor.  
 Clear the machine, add in the amount of increase 152829 and  
 divide by the 1912 Revenue, using the first four figures only, i. e.,  
 1312, = 11.6% with a remainder of 637.  
 Or better—With the large machine,  
 Add in the 1913 Revenue . . . . . 1465289.  
 Subtract the 1912 Revenue . . . . . 1312460.  
 Jot down this increase . . . . . 152829.

Divide directly by 1312 = 11.6%, Remainder . . . . . 637  
 Prove as follows: Leave in the machine and multiply  
 11.6 by the Divisor, 1312, 3-Factor Way . . . . . = 152192.  
 Or, hold 11.6 over itself for Key Factor and multiply  
 1312 multiplying towards the left = 152192.  
 Add in the Remainder . . . . . 637.  
 Which gives . . . . . 152829.  
 And proves the division.  
 Now continue and add the 1912 Revenue . . . . . 1312460.  
 This gives the 1913 Revenue . . . . . 1465289.  
 Which proves the subtraction.

With the 12 Column Comptometer, this is done without clearing  
 and re-setting the 152829 at the right, as is necessary with the  
 smaller Comptometers.

### AVERAGE PERCENTAGE OF EARNINGS ON CAR LOAD COMMODITIES

The information wanted here is:

The percentage of each commodity tonnage;  
total tons carried; total tons carried one mile.

The percentage of each Commodity Earnings  
to Total Earnings.

The Average Weight in tons, per car.

The Average Distance hauled in miles.

Earnings per ton in dollars and cents.

Earnings per ton per mile in cents.

The totals for each commodity are abstracted from the Individual Commodity Car Load Sheets.

11 Other Agricultural Products	109	11760	120	1475670	82	1671245	94	108	1255	1421	0113
Total	6625	154289	12973	25057911	1663	29743264	169	223	1879	1228	0106
Last Month	6726	154214	1248	26010100	1542	27117540	1689				
ANIMALS AND ANIMAL PRODUCTS											
12 Live Stock	480	12160	124	2440000	118	2716321	157	274	1626	2069	0127
	19676	813411	6620	150442089	6776	1434566	84	6464			
GRAND TOTAL	26781	980860	10000	180670000	10000	1759162	73	10000			

These statistics are worked up for each branch and on many Roads for each division of a road.

(\*Last month's Totals not added in Grand Total.)



**AVERAGE PERCENTAGE OF EARNINGS ON CAR LOAD COMMODITIES—Continued****COMPTOMETER WORK**

Add the number of car loads: 811, 903, 721, etc. = 6,626 and Grand Total, 26,781.

Add the tons carried, 16,214, 18,060, etc. = 154,289 and Grand Total, 980,860.

Add the tons carried one mile, 2,594,162, 2,916, 2,067, etc. = 28,057,911 and Grand Total 180,670,000.

Add the earnings, 26,716.45, 31,714.65, etc. = \$297,432.64 and Grand Total, \$1,759,162.73.

**Figure each commodity percentage of tons carried:**

As each total is a constant divisor for all of the commodities, use the Reciprocal Method:

Divide 1 by 980,860 and prove = 10,195 for the Reciprocal.

Hold the Reciprocal for Key Factor at the left of Keyboard, (Split it and use 101 first, then 95) and multiply the tons carried, 16,214 = 1.65%

Work up each commodity percent of the tons carried in the same manner:

Add all the percents to grand total, which should balance to 100%.

Continue in the same manner for the tons carried one mile and the earnings.

**Find the average weight of commodities in tons, per car:**

Divide the tons carried by the car loads.

Add the tons carried, 16,214, in the Comptometer at the left and divide by car loads, 811 = 20.0 tons.

Continue in this manner for all commodities.

**Find average distance hauled:**

Divide the tons carried one mile by the tons carried.

Add 2594162 in the Comptometer at the left and divide by 16,214 = 160.0 miles. Continue in the same manner for each commodity.

**Find earnings per ton carried:**

Divide the commodity earnings by the number of tons carried.

Add 26,716.45 in the Comptometer at the left and divide by 16,214 = \$1.648.

Continue in the same manner for each commodity earning.

**Find earnings per ton, per mile:**

Divide the earnings, \$26,716.45 by the tons one mile, 2,594,162 = .0103 per ton per mile.

## LOCAL TICKET OFFICE

### DAILY REPORT OF TICKETS SOLD

Some Railroad Stations employ several Ticket Sellers who sell from the same stock of tickets during the day, i. e., Brown sells from 10 P. M. to 6 A. M.; Jones from 6 A. M. until 12 M.; Smith from 12 M. to 10 P. M.

The form following illustrates a very small portion of the Ticket Work, as there are **many kinds of tickets**, each of which will be written and proven in the same manner.

Each clerk going off duty makes out his statement of the closing numbers on all tickets and extends the number sold of each. The incoming clerk will verify the closing numbers when he takes charge of the tickets.

[illegible]

## COMPTOMETER WORK

**Find amount of money each Ticket Seller must remit.**

Subtract the "Commencing Numbers," 165, etc., from the "Closing Numbers," 168, etc., equals 3, the number of tickets sold.

**Find Value of Tickets Sold during each Tour.**

Hold the Rate for Key Factor and multiply the number of Tickets sold, accumulating to the total.

$3 \times 17$

$3 \times 19$

23x21 etc. = \$101.50, To be remitted by Clerk 1.

Count the Cash and add Cash Denomination Slip, proving against the extension of the tickets.

**Continue for other Ticket Sellers in the same manner.**

### Find the Value of Sold Tickets from Stubs.

Some roads provide a stub on each ticket. This is detached when the tickets are sold and the value of the Ticket Sales is found by adding the stubs.

Add the value of each stub directly on the Comptometer. Jot an occasional running sub-total on a slip and drop it in the pile of added stubs. This provides for a sure and easy proof direct from the original figures. Re-add and check each sub-total as found correct. Adjust any correction on the last sub-total slip.

Bring to a Summary the amounts for each of the several classes of tickets and add for the days total = 594.13.

# AUDITOR OF PASSENGER RECEIPTS

The principal items of work in this office are:—

- Making up Train Earnings.
- Verifying Conductors' Cash Reports.
- Verifying Daily Ticket Reports.
- Verifying Monthly Ticket Reports.
- Compiling Foreign Interchangeable Mileage Reports.
- Compiling Interline Reports.
- Compiling Passenger Traffic Statistics.
- Compiling Station Balance Sheets.
- Making up Passenger Rates.
- Compiling "Passengers One Mile."
- Division and State Earnings.
- Verifying Dining Car Checks.
- Verifying Excess Baggage Reports

## CONDUCTOR'S CASH FARE COLLECTIONS REPORT

2-97-05 130 M 34-770 Form 1085.

### SOUTHERN RAILWAY COMPANY.

#### REPORT OF CONDUCTOR'S CASH FARE COLLECTIONS

For Train No. 37 Leaving Jarvis at 8:10 A 1912  
Arriving Macon at 4:50 1912

Duplicate No.	FROM	TO	Class	No. FARES	Rate	AMOUNT	Miles (Leave blank)	If Collection is made at less than Conductor's Rate, state why
3167	164	175	1	1	49	49		
68	164	190		3	56	1 68		
69	164	206		2	59	1 18		
70	168	307		1	78	78		
71	168	314		2	16	32		
72	175	190		2	21	42		
73	190	206		1	100	1 40		
74	206	307		1	146	1 46		
75	473	516		1	195	1 95		
76	483	518		2	215	4 30		
77	490	499		1	264	2 64		
78	495	499		1	548	5 48		
79	495	518		1	616	5 16		
						48 17		
						75 90		

TOTAL FARES AND CASH

Mileage separate report for each train run. Enclose in same envelope with Ticket Collections. Show exact leaving and arriving time of train.

P. J. Wrightson  
Conductor

This is a record of the Cash Fare collections. It shows the "stations from and to," the number of fares, and the rates. The original extensions, and footings are made by the Conductor.

The Comptometer work is verifying extensions and totals.

### METHOD

Hold the Rates for Key Factors and multiply the number of tickets, accumulating to the total of collections; add in .49, multiply  $3 \times .56$ ,  $2 \times .59$ ; add in .78, etc., equals \$75.90. This proves both extensions and addition.

## PASSENGER CONDUCTOR'S CAR REPORT

## BOSTON &amp; MAINE RAILROAD

*Boston*

DIVISION.

Passenger Conductor's Car Report,

*J. B. Brown 7/3/1913*

Conductor.

Train No.	Engine No.	Car Initials	Car No. or Letter	Loaded	Empty	Name of Car	Class of Car	Where Taken	Where Left	Mileage
26	165	2578	28				Pass	0-119		
		do	37				do	0-119		
		do	490				do	0-119		
		do	573			Passenger	do	0-75		
		do	670			Passenger	do	0-75		
		do	786			Pass	do	0-119		

This report is made up by the Conductors on each train. It details the car numbers, mileage, and class of service for each car.

## METHOD

A 12-Column Comptometer is best because it enables the abstracting of two or more services at the same time.

Place all of the Conductors' "Car Reports" at the left of the Comptometer and add the "Passenger Car Miles" on the right of Keyboard, as:

119, 119, 119, 119, etc., for total "Passenger Car Miles" of all the reports. Add the "Special Car Miles" on the left, as:

75, 75, etc., for all reports.

One report only is shown.

## PASSENGER CAR MILES

This is a Recap. of the daily totals of all trains operated.

## METHOD

Cross-add the "Daily Mileage" for the several services, as:

$$11768 + 9807 + 11561 = 33136.$$

Add the "Daily" items of each service for the "Month's Total,"

$$11768 + 11642, \text{ etc.} = 838503$$

Prove the sum of these "Totals" against the footing of "Cross-Total" columns, i. e.,

Cross-add the totals of the columns 1-2-3 = 765553.

Add the "Total" column which proves against same.

Proceed in same manner for each class of "Car Mileage."

### PASSENGER AUDITING

#### DAILY AND MONTHLY TICKET REPORTS

The Agent inserts the Commencing and Closing numbers of each series of Station Tickets, the Number Sold, the Rate and Amount.

He also extends the Tickets Sold by the rates, adds the number sold and the amounts.

Corresponding Reports are made for other classes of tickets such as:—

Card Tickets.

Half Tickets.

Excursion Tickets.

Clerical Tickets.

Specials.

Mileages, etc.

F	DESTINATION	Form	Commencing	Closing	No. Sold	Rate	AMOUNT
1	Buffalo, N. Y.	Card	365	392	27	24	648
2	Lackawanna, N. Y.	"	4672	4724	52	26	1352
3	Blackell, N. Y.	"	148	173	25	31	775
4	Big Tree, N. Y.	"	494	523	34	46	1564
5	Saratoga, N. Y.	"	160	173	13	49	637
6	Hamburg, N. Y.	"	398	402	24	56	1320
7	Ashel Springs, N. Y.	"	167	170	3	67	201
8	Hamburg-on-the-Lake, N. Y.	"	246	255	9	71	639
9	Lake Side, N. Y.	"	567	602	35	91	3185
10	Champlain, N. Y.	"	589	702	113	102	11526
11	Watkins, N. Y.	"	4678	4803	125	116	14500
			1137	2323	186		22639
			14601	15247	646		58995

#### COMPTOMETER WORK

Prove the Number of Tickets Sold by Series and Total.

#### METHOD 1

Add the "Commencing Numbers" and the tickets sold,

365+27 = "The Closing Number," 392.

Add the Tickets Sold for proving Agent's Total, 646.

#### METHOD 2

Add the "Commencing Numbers," 365, 4672 etc. .... = 14601

Clear and add the "Closing Numbers," 392, 4724. .... = 15247

Now subtract the total of the "Commencing Numbers" ..... 14601

The result will prove against the total of tickets sold. .... 646

#### Proving Extensions.

Extend the "Tickets Sold" by the corresponding rates, accumulating to the total,

27 × 24

52 × 26

25 × 31 etc. = \$589.95

The "Monthly Ticket Report" is the same as the Daily, excepting that it contains the commencing and closing numbers at the beginning and end of the month and the total of each series of Station Tickets sold.

Verify in the same manner as the "Daily Ticket Report."

## TRAIN EARNINGS

Working up a Train Earning on the Mileage Basis.

A ledger sheet is written up for each train operated. The "Passenger Train Earnings" are shown by the various tickets taken up and cash fares collected. The tickets are segregated into classes, as Card Tickets, M-X-S-X Tickets, school miles, etc., and turned in by the Conductor together with his "Cash Collection Report."

## ADDING THE TICKETS

With a bunch of card tickets on or right beside the Comptometer, add the mileage represented by each ticket. Thus the total of Card Tickets, etc., for Train No. 37 was 7160 miles.

Post this amount to the following Summary for train 37.

Dist.	Card, S. T. M. X. S. X, M. T. S. F. B. Mileage 1 P. T. L. Miles	M. X. (2)-S. X. Min. S. R. T. S. X. I. P. T. Interline Fare. Com. Miles	Walt Miles	G. P. A. Spl. Miles	Employee Quarterly Bus. School Miles	Monthly Bus. Miles	Miles	Miles	Tickets Received But Not Lifted	Cash Collections Revenue
1	7160	1640	360	460	760	760			1640	7590
2	6414	1390	580		480	480			1723	6740
3	3916	1375	461	765	374	826			940	10467
4	8716	1500	73		162	740			1726	3149
5	4923	1694	92	843	307	823			2746	4874
6	7240	1723	164	723	164	964			245	6795
7	5870	960	178		185	764			760	9276
8	7460	740	83	194	190	185			940	4716
9	6917	860	192		176	280			670	9173
10	7246	1491	746	167	480	307			123	8467
11	9163	780	845	368	723	164			840	2179
Total	75925	14153	3771	9534	4001	6303			18853	73421
Rate	2 1/2	2	1 1/2	2 1/4	1 1/2	1 1/2		TOTAL		
Am't.	1875 63	283 06	4714	7963	5001	7091		2406 38		3329 12

Continue in the same manner for all classes of tickets. The Money Value of "tickets not taken up" and of the cash collections are abstracted from the Conductor's Report. (Not Shown.)

## COMPTOMETER WORK

At end of the Period:

Adding for totals:

Add and prove the total mileages of all tickets bearing the same mileage value, 7160, 6414, 3916, etc. = 75025 miles @  $2\frac{1}{2}$ c rate, 14153 miles @ 2c rate, etc.

Add the value of tickets not lifted,  
16.40, 17.43, etc. = 188.53

And the Cash Collections,  
75.90, 67.40, etc. = 734.21

Extend each mileage total by its respective rate,  
 $75025 \times .025 = 1875.63$   
 $14153 \times .02 = 283.06$

Cross-add all money values of tickets lifted, 1875.63, 283.06, etc., and jot down the result, \$2406.38. Then continuing, add the values for tickets not lifted, 188.53 and the Cash Collections, 734.21 = Total, \$3329.12.

Prove by extending accumulatively over the Fixed Decimal, the mileages by the rates = \$2406.38.

Add in the Cash Fares and unlifted tickets = \$3329.12.

Some railroads work up the Money Value of tickets daily instead of the mileages. The rate or mileage is usually printed on the ticket.

### TRAIN EARNING RECAP.

The "Cash, Tickets Honored, and Tickets Lifted" are abstracted from the foregoing Summaries to the "Ticket Earning Recap."

The Data Wanted:— The Totals for all trains for the month, i. e.,  
The Total Number of Trips made, Miles Run,  
Cash Collections, Tickets Honored and the averages per trip and train mile.

TRAIN EARNING RECAP															FORM 1289					
COMPANY																				
AND MIXED TRAIN REVENUE																				
11 1915																				
VENUE										AVERAGES PER TRIP				Revenue per Train Mile						
Tickets Lifted		Total		Cash		Total Collections														
W. Brown	39	"	"	26	2444	765	29	190	762	160	73	3116	78	29	43	1	28	04	1	3621
Maclun	40	"	"	26	2444	842	64	942	75	1546	90	3332	29	32	44	1	28	16	1	3635
Neumen	43	"	"	28	2632	590	00	140	00	1725	68	2453	68	21	07					9330
Gates	44	"	"	29	2726	670	00	153	40	1416	29	2239	69	23	10					8216
				957	8995	2009	46	544	96	52620	01	85244	44							
				1092	102648	3464	60	7160	40	64875	99	99718	00	28	03	91	31			9715

### COMPTOMETER WORK

#### The Totals:

Add the Number of Trips, 26, 26, 26, 28, etc. = 1092 Trips for all trains.  
Add the Miles Run, the Cash, the Tickets Honored, Tickets Lifted and Totals.

Cross-add the Totals of Train Revenue Items, and prove against the footing of Total Column.

#### Figuring Averages Per Trip:

Add the Cash Train Revenue, \$734.21, in the Comptometer at the left and divide by the number of trips, 26, equals \$28.24, the Average Cash Collections Per Trip.

Work up the total collections in the same manner, equals \$128.04, the Average Earnings Per Trip.

The average earnings for each train are worked up in the same manner.

#### Revenue Per Train Mile:

Add in the Total Train Revenue, 3329.12, at the left and divide by the "Miles Run," 2444, equals \$1.3621, the Revenue Per Train Mile.

Continue in the same manner for each train.

Then add for the totals and work up the Grand Averages for all Trains in the same manner.

This work may become voluminous, as different railroads may have a movement varying from a few to hundreds of trains daily.

## INTERCHANGEABLE MILEAGE REPORTS

In certain localities Railroads will issue "Interchangeable Mileage," which may be used on a number of roads. The Road taking up the mileage coupons must make a report of same and collect from the Road which issued the mileage.

Chicago, Milwaukee & St. Paul Railway Co.											
GENERAL AUDITING DEPARTMENT—TICKET AUDITOR'S OFFICE, Chicago, <i>Nov. 14</i> 19 <i>12</i>											
Statement of Mileage issued by <i>C. B. + 2</i> R'y, honored in <i>October</i> 19 <i>12</i>											
NO. STRIPS	MILES EACH	TOTAL MILES	NO. STRIPS	MILES EACH	TOTAL MILES	NO. STRIPS	MILES EACH	TOTAL MILES	NO. STRIPS	MILES EACH	TOTAL MILES
	0		<i>25</i>	50		<i>5</i>	100	<i>500</i>	<i>7</i>	150	<i>1050</i>
	1		<i>22</i>	51		<i>21</i>	101	<i>2151</i>	<i>6</i>	151	<i>906</i>
	2		<i>49</i>	52		<i>16</i>	102	<i>1632</i>	<i>16</i>	152	<i>2432</i>
<i>8</i>	3		<i>18</i>	53		<i>37</i>	103	<i>3811</i>	<i>12</i>	153	<i>1836</i>
	4		<i>13</i>	54		<i>31</i>	104	<i>3224</i>	<i>7</i>	154	<i>1078</i>
<i>26</i>	5		<i>26</i>	55		<i>43</i>	105	<i>4515</i>	<i>4</i>	155	<i>620</i>
<i>14</i>	6		<i>14</i>	56		<i>172</i>	106	<i>18232</i>	<i>5</i>	156	<i>780</i>
<i>16</i>	7		<i>22</i>	57		<i>10</i>	107	<i>1070</i>	<i>28</i>	157	<i>4396</i>
<i>185</i>	8		<i>187</i>	58		<i>19</i>	108	<i>2052</i>	<i>1</i>	158	<i>158</i>
<i>216</i>	9		<i>72</i>	59		<i>14</i>	109	<i>1526</i>	<i>5</i>	159	<i>795</i>
<i>23</i>	10		<i>56</i>	60		<i>26</i>	110	<i>2860</i>	<i>14</i>	160	<i>2240</i>
<i>42</i>	11		<i>79</i>	61		<i>17</i>	111	<i>1887</i>	<i>17</i>	161	<i>2727</i>
<i>147</i>	12		<i>87</i>	62		<i>28</i>	112	<i>3126</i>	<i>3</i>	162	<i>486</i>
<i>8</i>	13		<i>64</i>	63		<i>43</i>	113	<i>4859</i>	<i>17</i>	163	<i>2771</i>
<i>78</i>	14		<i>37</i>	64		<i>16</i>	114	<i>1824</i>	<i>14</i>	164	<i>2296</i>
<i>19</i>	15		<i>26</i>	65		<i>119</i>	115	<i>13685</i>	<i>7</i>	165	<i>1153</i>
<i>214</i>	16		<i>21</i>	66		<i>7</i>	116	<i>812</i>	<i>6</i>	166	<i>996</i>
<i>196</i>	17		<i>17</i>	67		<i>18</i>	117	<i>2106</i>	<i>3</i>	167	<i>501</i>
<i>475</i>	18		<i>5</i>	68		<i>121</i>	118	<i>14278</i>	<i>4</i>	168	<i>672</i>
		<i>31764</i>			<i>52346</i>			<i>33865</i>			<i>30826</i>
		<i>55173</i>			<i>102069</i>			<i>117985</i>			<i>58731</i>

The Mileage Tickets or Coupons are segregated, according to the Roads issuing.

The Mileage for each Road is segregated according to Distances and entered on the "Interchangeable Report" opposite corresponding Distances.

## METHOD 1

Multiply the "Number of Strips" by the corresponding miles, accumulating to the total of the column,

$$\begin{array}{l} 8 \times 3 \\ 26 \times 5, \text{ etc.} \end{array}$$

55173 miles.

Prove by refiguring in the same manner.

## METHOD 2

Multiply each item of strips by corresponding Mileage and jot down the extensions,

$$\begin{array}{l} 5 \times 100 = 500 \\ 21 \times 101 = 2121, \text{ etc.} \end{array}$$

Add the "Total Miles" columns.

A Recap is made from these totals and added and proven.



# INTERLINE TICKET SALES

The report of Interline Ticket Sales is made up in the Auditing Office. It shows the through rate, the Proportion for the Foreign Road and the Amounts.

FORM 1133		A.S.S.'S STANDARD NO. 1	
GREAT WESTERN RAILROAD CO.			
ACCOUNTING DEPARTMENT.			
REPORT OF INTERLINE TICKET SALES			
MONTH OF <u>July</u> 191 <u>2</u>			
J. F. WADE, AUDITOR OF PASSENGER RECEIPTS.			
FORM	COM.	CLOS.	THROUGH RATE
Bx	162	164	2
BC	164	169	5
D4	2167		1
X7	310		1
	211	314	3
	315		1
	316	319	3
X6	3192	3188	
B16	48		1
	49	67	18
	67	75	8
D1	75	89	14
16 10 10			765 12
50 32 27			1380 15

## METHOD

Multiply each number of tickets sold by the Proportions, as:

2 Tickets @ 12.50 = 25.00

5 Tickets @ 10.75 = 53.75

Add the amounts, 25.00, 53.75, 5.20, etc. = \$1380.15.

Or better—Accumulate the amounts to totals for each 5 to 10 items.

Add the several classes of tickets, 2-1-3-1, etc. = 50.

For proof, accumulate the extensions,

2 × 12.50

5 × 10.75

1 × 5.20, etc. = \$1380.15

## PASSENGER STATISTICS

The principal items worked up in this department are:

Passengers Carried One Mile, State and Division Earnings, Revenue per Train Mile, Average Passengers per Train, etc.

## PASSENGERS CARRIED ONE MILE AND DIVISION EARNINGS

One of these statements is made up for each station.

The number of Passengers, the Miles and the Revenue are abstracted from the "Station Balance Sheet."

Sheet No. <u>146</u>		Form 2403													
by <u>RM</u>															
s by <u>COM.</u>															
as aud by <u>SLC</u>															
		PASSENGER STATISTICS MONTH OF <u>Jan</u>													
SYSTEM		Div. 1							Div. 2						
STATION	Miles	PASSENGERS ONE MILE	REVENUE	PASSENGERS	MILES	PASSENGERS ONE MILE	%	Revenue	PASSENGERS	MILES	PASSENGERS ONE MILE	%	Revenue		
<u>Jennettville</u>	<u>28</u>	<u>4536</u>	<u>102.06</u>		<u>16</u>		<u>571</u>			<u>12</u>		<u>412</u>			
" <u>Clinton</u>	<u>31</u>	<u>36890</u>	<u>830.02</u>		<u>16</u>		<u>419</u>			<u>15</u>		<u>581</u>			
" <u>Hamlet</u>	<u>33</u>	<u>18711</u>	<u>421.00</u>		<u>16</u>		<u>482</u>			<u>17</u>		<u>570</u>			
" <u>Elm</u>	<u>25</u>	<u>980</u>	<u>22.05</u>		<u>19</u>		<u>518</u>			<u>16</u>		<u>452</u>			
" <u>Hamlet</u>	<u>41</u>	<u>1842</u>	<u>41.51</u>		<u>19</u>		<u>469</u>			<u>22</u>		<u>336</u>			
" <u>Clinton</u>	<u>45</u>	<u>30400</u>	<u>729.00</u>		<u>6</u>		<u>133</u>			<u>39</u>		<u>529</u>			
" <u>Elizabethtown</u>	<u>7</u>	<u>343</u>	<u>7.72</u>		<u>35</u>		<u>714</u>			<u>14</u>		<u>266</u>			
" <u>Massena</u>	<u>55</u>	<u>2035</u>	<u>40.79</u>		<u>28</u>		<u>550</u>			<u>27</u>		<u>470</u>			
" <u>Pennsylv</u>	<u>59</u>	<u>472</u>	<u>10.62</u>		<u>14</u>		<u>287</u>			<u>45</u>		<u>760</u>			
" <u>Malbelle</u>	<u>63</u>	<u>1197</u>	<u>26.93</u>		<u>29</u>		<u>460</u>	<u>780.98</u>		<u>34</u>	<u>610.01</u>	<u>514</u>	<u>1365.72</u>		
" <u>Hamlet</u>	<u>60</u>	<u>130</u>	<u>2.92</u>		<u>49</u>		<u>794</u>			<u>16</u>		<u>216</u>			
		<u>49,889</u>	<u>1,126.65</u>		<u>19346</u>		<u>39416</u>			<u>30545</u>		<u>732.49</u>			
		<u>149428</u>	<u>3,366.28</u>		<u>57999</u>		<u>1,171.35</u>			<u>91629</u>		<u>2,104.93</u>			

## PASSENGERS ONE MILE

## METHOD

Multiply the Number of Passengers, 162, by the Miles Carried, 28, equals 4536, the equivalent of Passengers Carried One Mile.

Continue in this manner for all Passengers.

Or Better,

Accumulate to a sub-total for every 10 to 15 items,

$$162 \times 28$$

$$1190 \times 31, \text{ etc., for 10 items,}$$

equals 99409, as shown on form.

Leave this in the machine and continue with accumulations until the total mileage, 149428, is accumulated.

## DIVISION PASSENGERS ONE MILE

The Division Miles and Percents are abstracted from the Rate Book.

## METHOD

Multiply the Division Miles by the Passengers, accumulating to sub-totals for every 10 to 15 items,

$$162 \times 16$$

$$1190 \times 16, \text{ etc.,} = 38355, \text{ continuing to the total,} = 57799.$$

Continue in the same manner for each division of the Road.

**PASSENGER STATISTICS—Continued**

**DIVISION EARNINGS**

Different Railroads will have from two or three to sixty Divisions over which the earnings are distributed.

Figure the Earnings in the same manner as the passenger miles,

$$102.06 \times .571$$

$$830.02 \times .419, \text{ etc., to the total, } \$1177.35$$

Add the totals of Division Passenger Miles, 57799, etc. = 149428, which proves against the total Passengers One Mile.

Add the totals of the Division Revenues, 1177.35, etc., which proves against the total Revenue, \$3366.28.

All of these statements are Recapped to a Summary for the entire system.

**GENERAL BALANCE SHEET**

The General Balance Sheet is a summary showing the entire, classified Revenue of Passenger Trains from each Station. The amounts are all abstracted from other sources.

**COMPTOMETER WORK**

Cross-add all items of Revenue for each Station, 1367.25, 4622.31, 17.23, etc. = \$9975.94.

Add the items for each class of Revenue from all

Stations, 1367.25, 670.46, etc. = \$23666.03.

Cross-add the totals and balance against the sum of the Cross Totals.

### PRORATING OR DIVIDING PASSENGER RATES

A Passenger Rate Division clerk spends much time in multiplying and dividing. The Comptometer method greatly simplifies the work.

#### ADVANTAGES

Accuracy is Promoted.

A Record is obtained for Every Division in Detail.

The Efficiency of the Clerk is increased 20 to 50%.

The Expense is reduced accordingly.

Every Division, regardless of Complications, can be made easily on the Comptometer.

In illustrating the following method, this sign,  $\ominus$  will signify **Prorate**.

The methods employed are to have the Division Clerk outline the basis of division and turn the Division Slip over to the Comptometer operator, who figures the prorations and enters same on the Division Slip.

FORM A

(FRONT)

FROM <u>Chicago</u>	TO <u>St Petersburg, Fla.</u>	FORM <u>6181</u>
RATE <u>36.50</u>	CLASS <u>H S</u>	DATE <u>1/12</u>
ROADS	JCT. PTS.	PROPNS.
<u>C. &amp; E. I.</u>	<u>Evansville</u>	<u>11.50</u>
<u>L. &amp; N.</u>	<u>Nashville</u>	<u>4.31</u>
<u>N. C. &amp; St. L.</u>	<u>Atlanta</u>	<u>6.55</u>
<u>C of Ga</u>	<u>Macon</u>	<u>2.31</u>
<u>G. I. &amp; F.</u>	<u>Tifton</u>	<u>2.35</u>
<u>A. C. L.</u>	<u>Destin</u>	<u>9.48</u>
		<u><u>36.50</u></u>

Other Roads find it more advantageous to supply Division Clerks with Comptometers, to work out prorations and enter direct on the Division Slip.

The advantage claimed for this method is that the Division Clerks, due to their familiarity with the Prorate, can figure the proportions on the Comptometer about as quickly as they could outline the basis of Division on the Division Slip.

A form of Division Slip similar to that illustrated has many advantages. The principle can be worked effectively in connection with any **form, slip or system**. The roads and junction points are filled out on the Division slip by the Apportionment Clerk. It is then passed to the Division Clerk for prorating.

The Division Clerk outlines the **Basis of Division** on the back of the slip.

# PRORATING OR DIVIDING PASSENGER RATES — Continued

FORM A

(BACK)

CONSTRUCTION OF RATE	BASIS OF DIVISION	
11.50 to Evansville 25.00 beyond		$157 = \underline{3.56} + 75^c = \underline{4.31}$ $289 = \underline{6.55}$ $350 = \underline{7.93} \ominus \left\{ \begin{array}{l} 29.10\% = \underline{2.31} \\ 29.66\% = \underline{2.35} \\ 41.24\% = \underline{3.27} \end{array} \right.$ $274 = \underline{6.21}$
<b>ARBITRARIES</b> 75 <sup>c</sup> Evansville Bridge 11.50 local <u>12.25</u>	$25.00 - 75^c = \underline{24.25} \ominus$ 157 289 350 274 <u>1070</u>	

## METHOD

### Find the Net Rate Per Mile

Add the Miles,

157

289

350

274 = 1070 Miles.

### Deduct the Arbitrary

Add the Rate, \$25.00, in the Comptometer at the left and subtract the Arbitrary, .75 = \$24.25.

### Find the Rate Per Mile

Leave the 24.25 in the register and divide by the miles, 1070, equals \$.02266+per mile.

### Prorate \$24.25 on the Mileage Basis

Hold the miles for Key Factors and multiply the rate per mile,

$$.02266 \times 157 = \$3.56$$

$$.02266 \times 289 = 6.55$$

$$.02266 \times 350 = 7.93$$

$$.02266 \times 274 = 6.21$$

Leave the last item, 6.21, in the Comptometer, and add the other items, 3.56, 6.55 and 7.93 = 24.25, proving the Proration.

### Prorate 7.93 on Authorized Percentage Basis

Hold the 7.93 for Key Factor and multiply each per cent.

$$29.10\% = 2.31$$

$$29.66\% = 2.35$$

$$41.24\% = 3.27$$

$$7.93$$

Add the items for proof.

Enter the Proportions on the front of the form.

Add the A.C.L. items—6.21 and 3.27 = 9.48.

Add the Proportions, 11.50, 4.31, etc., to balance against the Through Rate, \$36.50.

Comptometer Results are underscoring.

**PRORATING PASSENGER RATES—Continued**  
**PRORATING ON THE BASIS OF RATES**

The two local rates are \$10.75 and \$25.00 or a total of \$35.75.

These two rates must be absorbed by the through rate \$33.00, i. e., the reduced rate must be divided between the two roads on the basis of the two regular rates.

**METHOD**

**Find What Per Cent the Special Rate is of the Regular Rate.**

Add 33.00 in the Comptometer at the left and divide by 35.75 = 92.3%

FORM A (FRONT)		
FROM <u>Chicago</u>	TO <u>San Francisco, Cal</u>	FORM <u>9-270</u> <u>275</u>
RATE <u>33.00</u>	CLASS <u>Colonist</u>	DATE <u>9/11</u>
ROADS	JCT. PTS.	PROPNS.
<u>C + A</u>	<u>St. Louis</u>	<u>5.21</u>
<u>C R I + P</u>	<u>Kansas City</u>	<u>4.71</u>
	<u>Texhoma</u>	<u>3.41</u>
<u>C R I + G</u>	<u>Bravo</u>	<u>9.9</u>
<u>C R I + E P</u>	<u>Santa Rosa</u>	<u>1.49</u>
<u>E. P. + A. W.</u>	<u>El Paso</u>	<u>3.62</u>
<u>San Pac</u>	<u>Destin</u>	<u>18.63</u>
		<u>35.75</u>

FORM A (BACK)	
CONSTRUCTION OF RATE	BASIS OF DIVISION
<u>8.00 to St. Paul</u> <u>25.00 beyond</u>	$33.00 \div \frac{10.75}{25.00} = \frac{2.92}{2.92} - 50\% = 9.45$ $50\% = 4.71 + 50\% = 5.21$ $40.96\% = 9.45$ $59.04\% = 13.63$
ARBITRARIES	$9.45 \div \begin{cases} 36.1\% = 3.41 \\ 9.8\% = .99 \\ 15.8\% = 1.49 \\ 38.3\% = 3.62 \end{cases}$
<u>50% St. Louis</u> <u>Bridge</u>	<p align="center">Comptometer Results are underscored</p>

**PRORATING PASSENGER RATES—Continued**

**Find Each Road's Proportion**

Multiply  $10.75 \times 92.3\% = \$9.92$ , Rate to Kansas City.

$25.00 \times 92.3\% = 23.08$ , Rate beyond Kansas City.

**\$33.00**

An Arbitrary for bridge charge goes to the C. & A. and the balance is Prorated on a 50% basis between C. & A. and C. R. I. & P.

Add in the Comptometer at the right . . . . . **\$9.92**

And subtract the Arbitrary . . . . . **.50**

**Gives the amount for prorating on 50% basis \$9.42**

Leave this amount in the register and multiply by 50% (3 Factor Way) = **\$4.71**

Add the 50c Arbitrary . . . . . **.50**

**Gives the proportion for C. & A. . . . . \$5.21**

Prorate 23.08 on Authorized Percents, 40.96% and 59.04%.

Multiply 23.08 by 40.96% = \$9.45 from Kansas City to El Paso

23.08 by 59.04% = 13.63 So. Pac. Rd.

Leave the last extension, 13.63, in the register and add 9.45 to it for proof of Proration = \$23.08.

Prorate \$9.45 on Authorized Percents,

36.1%

9.8

15.8

38.3

**100.0**

Multiply 9.45 by .361 = \$3.41 C.R.I. & P.

Multiply 9.45 by .098 = .93 C.R.I. & P.

Multiply 9.45 by .158 = 1.49 C.R.I. & E.P.

Multiply 9.45 by .383 = 3.62 E.P. & S.W.

Add the prorations to prove against 9.45, the Amount prorated.

Enter the Proportions on Division slip and add for proof against the through Rate of \$33.00.

## GENERAL AVERAGES AND PER CENTS OF INCREASE AND DECREASE

Traffic Statistics similar to the following are worked up for each Operating Division of the Road. Many Railroads require more minute Statistical Data than shown here.

PASSENGER TRAFFIC					
		This Month	Last Month	% Incr.	% Decr.
A	Road Mileage	3,058.64	3,037.04	.0071	
B	Train Mileage	5,286,229.	4,917,561.	.0750	
C	Car Mileage	29,343,656.	27,806,343.	.0553	
D	No. of Pass'rs carried	4,870,104.	4,573,532.	.0648	
E	" " " " one mile	231,202,542.	221,058,350.	.0458	
F	" " " " per mile	75,590	72,787	.0385	
	of Road				.0178
G	Avg. Distance carried per Pass'r	47.47	48.33		
H	Total Revenue from Pass'rs.	5,050,067.90	4,735,503.65	.0664	
I	Avg. Amt rec'd each Pass'r.	1.03695	1.03542	.0014	
J	Avg. Rec't per Pass'r per mile	.02184	.02142	.0196	
K	Total Pass'r Train Revenue	6,440,499.17	6,043,234.34	.0657	
L	Pass'r Tr. Rev. per Mile of Road	2,105.68	1,987.88	.0582	
M	Pass'r Tr. Rev. per Train Mile	1.21835	1.17560	.0350	
N	Avg. No. Passers per Train Mile	43.74	43.00	.0172	
O	Avg. No. Passers per Car Mile	6.025	7.95		.0988

## METHOD

Use "Last Month" as basis in figuring the per cent of increase or decrease.

Add the Road Mileage, 3058.64, in the Comptometer at the left and divide by "Last Month," 3037.04 = 1.0071%, or an increase of .0071%.

Continue in the same manner for all increases or decreases.

## If the Per Cent is a Decrease,

As "Average distance carried per passenger" this month, 47.47 miles is less than last month, 48.33 divided by 48.33 = 98.22%. The per cent of decrease is the difference between 98.22% and 100% or .0178. To register the per cent decrease, simply hold back the cut-off to the left of 9822 and add the negative of same, small —821, twice, = .0178% decrease.

- F. Add Passengers One Mile, "E," 231, 202, 542, in the Comptometer at the left and divide by the Road Mileage, "A," 3,058.64 = 75590.
- G. Add Passengers One Mile, "E," 231, 202, 542, in the Comptometer at the left and divide by the No. of Passengers, "D," 4870104 = 47.47 Miles Avg. (Using only five figures of Divisor.)
- I. Divide the Total Revenue, "H," by the number of Passengers, "D" = 1.03695.
- J. Divide the Total Revenue, "H," by the Passengers One Mile, "E," using the first five figures of the Divisor = .02184.
- L. Divide the Train Revenue, "K," by the Miles of Road, "A," = 2,105.68 Train Revenue per mile of Road.
- M. Divide the Train Revenue, "K," by the Train Mileage, "B," = 1.21835, Revenue per train mile.
- N. Divide the Passengers One Mile, "E," by the Train Mileage "B," = 43.74.
- O. Divide the Car Mileage, "C," by the Number of Passengers Carried, "D" = 6.025.



# CAR RECORDS—PER DIEM BILLS

A record is made in a large "Car Record Book," showing when each Foreign car is received, where it moves and when it is turned over to another road.

The Comptometer adds the Day's Service per car—adds the Car Record sheets for total days' car service for each Road.

## METHOD

### Adding Days' Service per Car.

Place the Comptometer beside Car Record Book, at the right. Hold the 1 key and add repeatedly for each day's service across the sheet, i. e., Car No. 74283. Hold the 1 key and add repeatedly for the 4th, 5th and 6th, and five times for the 17th to 21st = 8 days.

This method becomes very rapid during the first hour used and is absolutely accurate.

Continue in this manner until the day's service for each car is determined.

### Adding Total Days' Service for Each Road.

Place the Comptometer beside the Car Record Book, or if loose leaf sheets, use a Comptometer Bridge. Slide the sheets under the bridge so that the vertical column "Days' Service" is close to the Comptometer.

Add the column of Days' Service. Jot down the Running Sub-Totals at the end of each two or three pages; this so as to agree with the corresponding sections on Per Diem.

## PER DIEM REPORT

If the Per Diems are written up with pen, place them right beside the Comptometer. Add each of the 4 vertical columns of Days' Service. Jot down the total for each column and recap. on each sheet for the total.

Extension:

Hold the rate 45c for Key Factor and multiply the Days' Service, 888 = \$399.60, amount due the North and South Railway Co.

There may be required from 1 to 15 or 20 Per Diems to cover the report of "Car Service" for one Railroad.

## CAR RECORD BOOK

Form 4407

MOVEMENTS OF *West Michigan RR* CARS FOR YEAR 1912.

MONTH *March, 1912*

FIFTY MOVEMENTS UNDER RECD.

CAR No.	From	To	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
74283	8																																
114228	3																																
94502	1																																
102413	14																																

293

East & West Railroad Company

PER DIEM REPORT

Cars of *North and South R* Month of *June* 1910

NUMBER	DAYS	NUMBER	DAYS	NUMBER	DAYS	NUMBER	DAYS
26746	15	26790	26	27674	5	28176	9
31716	11	32164	7	37160	16	38175	11
38464	3	41726	11	41728	7	42164	13
44160	12	57190	7	59160	3	60170	14
76180	13	88193	2	80160	2	81176	9
TOTAL	1261	TOTAL	1271	TOTAL	1186	TOTAL	1141
TOTAL 322				TOTAL 177			
TOTAL 27				TOTAL OF SHEET 848			
Per Diem 888				days at 45 cents per day. 399.60			
191				F. C. TUCKER, Inc. Accountant, C.			

**TYPEWRITTEN PER DIEM REPORT**  
**ADDED AND EXTENDED ON COMPTOMETER**

NASHVILLE, CHATTANOOGA & ST. LOUIS RAILWAY								
PER DIEM REPORT.								
	Number	Per Diem	Number	Per Diem	Number	Per Diem	Number	Per Diem
1	6200	8	6510	3	14410	1	4310	14
2	11260	5	13730	5	6230	5	2140	2
3	6240	3	1240	2	6750	3	6950	2
4	4950	1	10460	3	4460	24	11770	1
5	10460	3	13570	5	6270	9	4470	4
6	7770	2	4980	1	11280	6	5390	11
7	13590	20	10201	22	2201	3	5711	3
8	6611	20	5821	6	451	1	5731	4
9	9731	2	13541	6	5641	1	14251	5
10	10851	2	14261	7	9461	2	13571	2
								229
11	5571	2	671	6	6171	1	5171	1
								263
								238
44	6759	1	7569	5	10468	17	3969	4
45	4979	1	14189	10	6399	9	13799	3
								50
780 days' car service @ 35¢ per day = \$273.00								780

**METHOD**

With the Car Record Sheets on the swivel directly over the Comptometer, write across the Per Diem Sheet four consecutive car numbers, and days service following the order on the Car Record Sheets. When about two "Car Record" sheets are written up, move the Platen so as to leave one blank space. This enables the items above the blank space to be added and proven against the corresponding Car Record sheets.

Continue in this manner until all of the Per Diems for one Road are completed.

**Adding the Per Diem:**

Place the Per Diems on or beside the Comptometer.

Add the four columns of "Per Diems" in first section, as, 8, 5, 3, 1, etc. = 229.

Jot down the total for each section and for the sheet.

If more than one sheet make a Total for each Per Diem and then make a recap. of the several sheets.

Or, sub-total the Per Diems; i. e., jot down the running Sub-totals on each Per Diem, carrying through all Per Diems for one road so that the last sheet shows the Grand Total.

**Extending Per Diem —**

Hold the rate 35c for Key Factor and multiply the number of days' car service = \$273.00.

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**WRITING UP "PER DIEM" REPORTS**

This method employs an ordinary typewriter and a swivel holder to hold the "Car Record Sheets" above the typewriter.

The Car Record is held above the typewriter so that the car numbers and days can be easily read. A typist soon becomes proficient and is able to write by touch with about two weeks' use of typewriter on Per Diem work.

**SWIVEL COPY HOLDER  
SWUNG TO ONE SIDE**

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**AN EFFECTIVE COMBINATION OF COMPTOMETER AND TYPEWRITER**

## CONDUCTORS' WHEEL REPORTS

S M Form 510  
SHEET No. \_\_\_\_\_

**A. & W. P. R. R.—The W. Ry. of Ala.**

Train No. 76 Left Cary, 10 PM Jan 6 1913  
 Eng. 346  
 Arrived at Harrisburg 9.20 1913

Station Smith Conductor Jones

INITIALS	NUMBER	Kind	Taken From	Left at	W. of A.		A. & W. P.		Gross	CONTENTS	TOWARD MILEAGE	
					Loaded	Empty	Loaded	Empty			Of Car	Contents
1	Caboose	1001	467	314			42	✓				
2		2167	467	314			42	✓	57	31		
3	CV	2180	467	314			42	✓		26		
4	P.R.R.	3792	116	716			58	✓		40	50	
5	"	4284	116	716			58	✓		31		
6	"	560	31	174			64	✓		15	26	
7	NYC.	17280	31	174			64	✓		27	31	
8	"	19460	31	174			64	✓		30	24	
9	"	570	43	316			49	✓		30	24	
10	MLO	491	13	946			126	✓		40		
11		370	13	728			74	✓		30	16	
12		560	13	728			74	✓	90	30	16	
13		216	13	728			74	✓		30	16	
14		570	173	58			7	✓		24		
15		31	94	64			21	✓		24	15	
16							542378	✓		24962	13180	
17	Tonnage Train									3675	38162	
18	TRAIN MILES 119											
19	TIME 9.10											
20	ENGINE RATING 178024											
21	GROSS TON MILES 38152											
22	PERCENT OF HAULING EFFICIENCY 244%											
23	EMPTY CAR MILEAGE 213											
24	LOADED CAR MILEAGE 844											
25	TOTAL CAR MILEAGE 1057											
26	% EMPTY CAR MILEAGE 33.7%											

Each Conductor makes up a report of the Train and Tonnage, which covers the movements of trains within the Divisions. These Reports show the Train Numbers, Starting Points and Destinations, the Car Numbers, Station Numbers, from and to which freight is carried, the miles run, weights of cars, and weights of car contents.

Data wanted from this Report is:

- Loaded Car Mileage;
- Empty Car Mileage;
- Percentage of Empties in Trains;
- Ton Miles for Cars and Contents;
- Gross Ton Miles;
- Average Speed;
- Percent Hauling Efficiency.

See "Comptometer Method" on following page.

# CONDUCTORS' WHEEL REPORTS—Continued

## COMPTOMETER WORK

### LOADED AND EMPTY CAR MILES AND PERCENTAGES

#### METHOD

With the Comptometer right beside the "Wheel Report,"

Add and prove both—The Loaded Car Miles.... 542  
and the—Empty Car Miles..... 275

Leave the last amount in the register and add to it the Loaded Car Miles = 817, Total Car Miles.

Clear and add in the "Empty Mileage," 275, at the left and divide by "Total Mileage," 817 = 33.7% of "Empties."

## TON MILES OF CAR AND CONTENTS

Group the tonnage of cars traveling the same distance, as:

<b>Cars</b>	}	Each Car traveled 42 miles.
31		
26		
<u>57 Tons</u>		

<b>Cars</b>	}	Each Car traveled 64 miles, etc.
15		
27		
<u>30</u>		
<u>72 Tons</u>		

<b>Contents</b>	}
26	
31	
<u>24</u>	
<u>81 Tons</u>	

Add and pencil in these tonnages, 57, 72, 90 and 81 and 48.

Figure the "Ton Miles," i. e., equivalent of tons hauled one mile.

Multiply, at the right of Keyboard, each mileage by the "Car Tonnage," accumulating for the total of the "Wheel Report."

as—  $42 \times 57$   
 $58 \times 40$   
 $58 \times 31$   
 $64 \times 72$   
 $49 \times 30$   
 $126 \times 40$   
 $74 \times 90$   
 $7 \times 24$   
 $21 \times 24$

Then accumulate the "Contents" in the same manner = 13190, Ton Miles for "Contents."

24,962 Ton Miles for Cars.

Add the "Ton Miles of Cars and Contents" 24962  
13190

Equals the **Gross Tons One Mile.** ..... 38152

## AVERAGE SPEED

Divide the "Train Miles," 119, by the "Hours on Road," 9½, i. e.,

Add 119 into the Comptometer at the left.

Divide by 9.167, equals "Average Speed" of 12.98 Miles per Hour.

## POTENTIAL TON MILES

The "Potential Ton Miles" represent the capacity of the Engine for the distance run.

The Rated Capacity of Engine No. 346 is 1496 Tons per Mile.

Multiply Rating per Mile, 1496,  $\times$  distance, 119 = 178024, Engine Rating or "Potential" Ton Miles.

## HAULING EFFICIENCY

This is the percentage of the actual Load to the Capacity.

Add in the Comptometer at the left, the "Actual Ton Miles," 38152, and divide by the "Potential Ton Miles," 178024..... = 21.4%  
"Hauling Efficiency."

# **RECAP. OF WHEEL REPORTS**

The data from the "Wheel Report," previously illustrated, is brought each day to the following "Recap," from which the Average daily speed is determined for all trains: The Average Hauling Efficiency;  
And the Average Number of Empty Cars.

<div style="text-align: right;">O.T. 229</div> <div style="text-align: center;"> <b>DIVISION FREIGHT CAR AND TON MILEAGE</b>  <small>(COMPILED UPON AN OPERATING DISTRICT BASIS)</small> </div>										
for <u>July, 1913</u> Sheet No. <u>146</u>										
Office of <u>Div. Supt.</u> At <u>Cleveland</u> Date <u>Aug. 1, 1913</u>										
FOR SLOW FREIGHT TONNAGE TRAINS							FOR ALL FREIGHT TRAINS			
Number of Trains or Engine Numbers A	TRAIN MILES B	HOURS BETWEEN TERMINALS C	Average Speed M. P. H. D—E—F	ADJUSTED TON MILES		Efficiency in Per Cent. G—H—I	CAR MILEAGE			
				Potential E	Actual F		Loaded J	Empty K	Total M—N—O	Percentage Empty L—J+K
26	119	9:10	12.98	178024	38,152	21.4	542	275	817	33.7
7642	94	10:42	8.8	216000	156,400	72.4	556	323	879	36.7
267	94	10:42	8.8	150700	123,725	82.1	642	112	754	14.9
571	106	8:15	12.8	374600	190720	50.9	376	416	792	52.5
70	126	14:20	8.8	190,724	100724	52.8	545	119	664	17.9
1603 140:75				2,886,114	1,585,199		6915	3237	10152	
	2142	194 <sup>24</sup>	11	3,996,162	2,194,920	55	9576	4482	14058	31.9

## **COMPTOMETER WORK**

Add and prove the "Train Miles," 119, 94, 94, etc. = 2142.  
Add and prove the "Hours Between Terminals," thus:  
Add the minutes first on the right side of Keyboard,  
10, 42, 42, etc. = 204,  
And reduce to Hours, i. e., divide by 60..... 3 Hrs., 24 Min.  
Now add the "Hours" at the left of the Minutes = 192 hrs.,  
24 mins.  
**Ascertain the "Average Train Speed," i. e.,**  
Add the "Train Miles," 2142, in the Comptometer at the left  
and divide by the "Hours," 194, =

11 Miles, Average Speed of all trains.

## **Determine the Average Percents of Hauling Efficiency and "Empties."**

Add the "Potential Tonnage" = 3,996,162  
Add the "Actual Tonnage" = 2,194,920  
Divide the "Actual" by the "Potential Tonnage," equals the  
"Average Hauling Efficiency," 55%.  
Add the "Loaded," "Empty" and Total Car Mileages and figure  
the per cent of "Empties" in the same manner, i. e.:  
Add the "Empties," 4482, in the Comptometer at the left and  
divide by the Total, 14058 = 31.9%.

# FREIGHT CAR MILEAGE

## CARD SYSTEM

The mileages for each car are abstracted from the "Wheel Reports" to the card, in detail, using one "Train Mileage Card" for each "Wheel Report."

MILEAGE CARD. Train No. 57		Jonesville to Cary		1/5/20			
Loaded	Empty	H.L.	H.E.	For. L.	For. Empty	Coal L.	Coal Empty
Home							28
1234	754	123	164	84	84	96	16
Foreign							16
398	128	490	173	28	28	84	18
Coal							29
1044	373	28	21	160		289	46
Refrig							75
165	280	1234	21	398		173	18
Refr			42			1044	67
do			754				16
							28
							161
							373

## Data Wanted:

- The Total "Home Loaded" Mileage for all trains;
- The Total "Home Empty" Mileage for all trains;
- The Total "Foreign Loaded" Mileage for all trains;
- The Total "Foreign Empty" Mileage for all trains, etc.

## COMPTOMETER METHOD

Add, on each "Mileage Card," the items for each class of service and jot in the totals at the left of card, i. e., 123, 264, 490, etc. = 1234 Miles "Home Loaded."

## ADDING THE TRAIN MILEAGE CARDS

Place the bunch of cards at the left of the Comptometer.

Add the "Home Empties" on the right side and the "Loaded" at the left of Keyboard, at the one handling of the cards, and carry totals to a "Daily Recap. Card."

Proceed in the same manner for the "Foreign" and "Coal Cars," etc.

# ENGINE MILEAGES AND PERCENTAGES

These items are abstracted daily to each "Engine Account" from the "Conductor's Car Report." The mileage in each class of service is entered separately.

## COMPTOMETER WORK

Add and prove the "Mileage" in each service —

Freight—26, 137, 148, etc. = 1012 Miles, in freight service.

Find the total for other services in the same manner.

## FIGURE THE SERVICE PERCENTAGES

Cross-add the "Service Totals"..... = 2847 miles

Find the reciprocal of 2847—

i. e., divide it into 1..... = 3513

Multiply each "Service Mileage" by this reciprocal, i. e.,—

1012 × 3513.....	35.6%
1026 × 3513.....	36.0
452 × 3513.....	15.9
357 × 3513.....	12.5

100.0%

These per cents are later used as a basis for distributing oils, waste, etc.

## MONTHLY RECAP.

The "Daily Recaps" are again abstracted to a "Monthly Summary" and the Daily Averages for the month determined for the trains on each division.

## GENERAL RECAP OF TRAIN MILEAGE AND TONNAGE

A further Summary is made up from these "Monthly Recaps" to show the total classified Train and Car Mileages for the entire road.

CHICAGO, BURLINGTON & QUINCY RAILROAD COMPANY							
OFFICE OF CAR ACCOUNTANT							
FREIGHT TRAIN & CAR MILEAGE							
Aug. 1912							
ACCOUNTING DIVISIONS	TRAIN MILEAGE			CAR MILEAGE			
	Freight	Mixed	Total	Loaded	Empty	Caboose	Total
<i>6</i>	<i>167450</i>	<i>55716</i>	<i>223166</i>	<i>1,674,640</i>	<i>874600</i>	<i>49728</i>	<i>2,598,968</i>
<i>X</i>	<i>217480</i>	<i>75170</i>	<i>292650</i>	<i>1,967,280</i>	<i>990720</i>	<i>487160</i>	<i>3,445,160</i>
<i>X4</i>	<i>371490</i>	<i>107160</i>	<i>478650</i>	<i>746923</i>	<i>350490</i>	<i>175280</i>	<i>1,272,693</i>
<i>56</i>	<i>167142</i>	<i>51716</i>	<i>218858</i>	<i>1,746,846</i>	<i>746728</i>	<i>346729</i>	<i>2,840,303</i>
<i>B</i>	<i>319167</i>	<i>94726</i>	<i>413893</i>	<i>670746</i>	<i>350716</i>	<i>1647261</i>	<i>1,86,188</i>
<i>D</i>	<i>17460</i>	<i>5165</i>	<i>22625</i>	<i>960846</i>	<i>455720</i>	<i>225495</i>	<i>1,642,067</i>
<i>F</i>	<i>37180</i>	<i>7164</i>	<i>44344</i>	<i>314960</i>	<i>157160</i>	<i>75460</i>	<i>547,580</i>
<i>W</i>	<i>49170</i>	<i>16714</i>	<i>65884</i>	<i>728749</i>	<i>346728</i>	<i>317160</i>	<i>1,392,637</i>
<i>WC</i>	<i>716400</i>	<i>216400</i>	<i>932800</i>	<i>1,946,723</i>	<i>964700</i>	<i>490716</i>	<i>3,402,139</i>
	<i>4,622,741</i>	<i>2,375,869</i>	<i>6,998,610</i>	<i>27,676,127</i>	<i>2,463,546</i>	<i>6,687,346</i>	<i>58,995,019</i>
	<i>6,685,680</i>	<i>3,005,795</i>	<i>9,691,475</i>	<i>38,433,840</i>	<i>29,869,120</i>	<i>9,019,800</i>	<i>77,322,760</i>

## COMPTOMETER WORK

Add each class of "Train Mileage" and "Car Mileage" to a total, 167,450, 217,480, etc. = 6,685,680.

Cross-add for Divisional "Train Mileage" and "Car Mileage," 167,450, 55,716 = 223,166.

Add the Freight, Mixed, Loaded, Empty and Caboose Totals, and prove against the sum of the two "Total" columns.



# STOREKEEPER

Some of the principal phases of the Storekeeper's work are:

- Proving Purchase Invoices;
- Figuring the Unit Price on each article;
- Invoicing to the departments all material transferred;
- Keeping Stock Ledger of Purchases and Consumption;
- Figuring all Material Requisitions;
- Distributing Material Requisition charges, etc.

## PURCHASE INVOICE DATA

Prove the Extensions;  
Prove the Deductions;

Prove the Additions;  
Figure the "Unit Cost."

EXAMPLE:

THE NEW YORK CENTRAL LINES		
TO THE		
SAWYER HARDWARE CO., DR.		
74 doz. Lamp Chimneys		
@ \$1.10 Doz.	\$81.40	
Less 9.50 Freight	9.50	
	71.90	
54 Station Lamps @ \$1.35 ea.		
Less 45%	40.10	
		\$112.00

## METHODS

### Prove the Extension

Use Fixed Decimal. Hold the price for Key Factor and multiply $1.10 \times 74$ .....	=	81.40
Deduct the Freight.....		9.50
Equals Net.....		71.90
Hold the price of the Station Lamps, 1.35, over Fixed Decimal, and multiply 54.....	=	72.90
Continue and multiply by the net of the discount, 55, (3 Factor Way).....	=	40.10
Add to this result the amount of previous extensions..		71.90
Equals Total.....		112.00

### Figure the "Unit Cost" Price

Multiply $12 \times 74$ at right of Keyboard.....	=	888 Chimneys
Clear and add 71.90 in the machine and divide by 888, equals the Cost of each Chimney.....		.08097
Multiply the "List Each" of Station Lamps, 1.35, by the net of the discount, 55, equals the cost of each lamp.....		.7425

## EXAMPLES OF OTHER ITEMS OF PURCHASES

168 pieces of 4×6 Pine 14' long		
equals 4704 feet @ 37.45 M.....	=	176.16
725 lbs. of Bolts @ 3.60 cwt.....	=	26.10
Less Discount 70-10-10.....	=	6.34
"Unit Price" per lb.....	=	.0087

84 Doz. Brooms @ 3.25 per doz.....	=	273.00
Less Discount 10%.....	=	245.70
"Unit Price".....	=	.24375

185 lbs. Steel @ 14.90 cwt.....	=	27.57
Less discount 50-10-10.....	=	11.17
"Unit Price".....	=	.0603

175 lbs. of Linseed Oil @ 1.85 gal.....	=	43.17
Linseed Oil weighs $7\frac{1}{2}$ lbs. to gal. "Unit Price".....	=	.2467

74600 lbs. Coal @ 1.65 per Gross Ton.....	=	54.95
---	---	-------

245 lbs. Nuts @ 3.75 cwt.....	=	
510 lbs. Nuts @ 4.20 cwt.....	=	
300 lbs. Nuts @ 4.40 cwt.....	=	
750 lbs. Nuts @ 4.80 cwt.....	=	

79.81

Less 70-10.....	=	21.55
-----------------	---	-------

The original extensions are itemized on invoice. Prove by accumulating to the total, where possible.

## REQUISITIONS

A "Requisition Slip" is authority for the Storekeeper to furnish material to be charged to the Department issuing same. Many requisitions will be for one item. These should be segregated according to classification, as the requisitions are filled.

## METHOD

Hold "Unit Prices" for Key Factors over Fixed Decimal and extend each item separately.

456 lb @ .048 . . . . . = \$21.89

Add the results for total . . . = 43.45

**TO PROVE:**

Accumulate over the Fixed Decimal, or simply re-figure, if only a single item on the requisition.

162		FORM 530	Leary	SNPS.	July 16, 1910
STORER/RECEIVER		DELIVER TO BEARER THE FOLLOWING ARTICLES, VIZ:			
QUANTITY	DESCRIPTION OF ARTICLE	WEIGHT	PRICE	AMOUNT	
26	Pieces No. 3 Bar Steel	456	0.48	21	89
15	Pieces 4x8-12 Hemlock	480	37 <sup>10</sup> / <sub>100</sub>	18	00
	Bolts	165	0.24	3	56
AND CHARGE THE SAME TO		Engine Repairs	Johnston	43	46

## STOCK CARDS

The "Stock Cards" contain memoranda of the Quantity Records and Purchase Prices. One card is used for each article; a memorandum is made for every quantity stocked and each quantity given out on requisition.

$6 \times \frac{5}{8}$ " Bolts }  
 $6 \times \frac{3}{4}$ " Bolts } Each size requires a separate card.  
 $8 \times \frac{5}{8}$ " Bolts }

STOCK CARD										
CARD NO	ARTICLE	MAX 7500	ACCT NO							
3164	Scourer	MIN 3000	14							
RECEIVED.				DISBURSEMENTS.						
DATE REC'D	QUANTITY	AMT.	UNIT PRICE	JAN	FEB	MAR	APR	MAY	JUNE	
12/20/10	15 gross	26.14	.0121	136	286	129	135	114	288	
1/10/11	10 gross	17.42	"	248	814	123	104	237	473	
2/17/11	12 gross	2.091	"	342	228	817	817	109	128	
3/6/11	28 gross	48.79	"	456	314	664	243	116	125	
4/13/11	25 gross	43.56	"	128	107	281	561	871	113	
5/18/11	15 gross	26.14	"	114	126	914	832	104	74	
5/25/11	15 gross	26.14	"	125	128	116	247	114	128	
130 gross 226.57				963	723	965	623	744	1237	
TOTAL REC'D	250 gross	435.61	0.121	2512	2676	3948	2562	2407	2566	
ON HAND FIRST OF SUCCEEDING MONTH				1088	140	223	261	12	1766	

## COMPTOMETER WORK

## January

Add the January disbursements,  
136, 248, etc. = 2512.

Clear and add quantities stocked on the right of Keyboard, 15 and 10 = 25 gross.

Reduce to units, i. e., leave this in the Register and multiply (3 Factor Way) by  $144 = 3600$ .

Leave 3600 in the Register and subtract out January disbursements, 2512 = 1088 on hand February 1st.

Each month's stock record is figured in the same manner.

# MIXED COMMODITY REQUISITIONS

Each "mixed commodity" Requisition will contain from two to eight or ten of the sixty-odd Commodities. There may be several hundred "Mixed Commodity Requisitions" for the day.

## "SPREAD" OR

DAILY ABSTRACT OF MATERIAL REQUISITIONS										RECAP	
ACCOUNT NUMBERS										ACCT. NO.	AMOUNT
ACCT. 1	4	5	7	8	11	16	20	25	28		
3.67	2.22	6.84	7.16	9.22	9.47	7.46	7.16	1	77.64		
4.25	4.36	7.92	8.32	11.16	7.49	8.92	8.31	4	26.44		
16.48	7.42	11.34	11.46	1.25	5.62	9.17	1.23	5	55.22		
9.76	3.27	4.67	7.15	6.84	2.65	8.47	4.36	7	46.20		
8.73	4.17	2.82	4.63	7.93	6.27	7.46	4.65	8	48.13		
4.87	26.44	4.56	7.48	4.65	4.73	5.13	4.71	11	36.33		
8.27		7.31	46.20	6.48	36.33	4.63	4.96	16	44.24		
9.46		4.76		48.13		54.24	7.37	28	53.02		
4.62		55.22					4.67	31	47.60		
7.33							5.64	46	34.86		
77.64							53.02	48	78.20		
#31	#46	#48	#51	#56	#57	#69	#81	51	39.87		
7.23	2.24	7.32	5.76	5.60	9.17	6.28	4.56	56	47.66		
6.44	9.36	7.47	8.21	7.32	6.67	9.01	5.67	57	56.73		
7.83	7.83	5.63	9.37	8.96	4.82	1.27	2.68	69	63.48		

## METHOD

Draw off the money values from the requisitions on a "Spread," entering each item of money under the corresponding Commodity.

With the Comptometer right beside the "Spread":

Add the several items for each Commodity, as: 3.67, 4.75, 16.48, etc., \$77.64, jotting down the totals.

Add the "Commodity Totals" for

"Grand Total," 77.64, 26.44, etc. = 397.22 for accounts 1 to 28.

Add the Requisitions directly in the Comptometer to prove against the "Commodities" Total."

Post each "Commodity Total" to the "Stock Ledger."

Prove the "Ledger Postings" in the same manner as for the Single Item Requisitions.

# STOCK LEDGER

The "Stock Ledger" contains the Money value of the "Commodity Accounts." For instance, the cost of all sizes of Bolts are brought to one general "Bolt Account," etc.

STOCK LEDGER				
DATE	BILL NO.		PRICE	AMT
8/6	260	700* <sup>3</sup> / <sub>4</sub> " Bolt Len 20-10	14.60°	22.59
8/7	416	240* Bolt Len 60-10	10.80°	13.65
8/9	419	170* Bolt Len 50-10	16.20	12.39
				46.72
				100.35

## COMPTOMETER WORK

Add the "money values" for each commodity on the Comptometer directly from requisitions.

Jot the amount on the back of the last Requisition and re-add for positive proof before posting.

Post this amount to the "Stock Ledger."

Prove the Postings.

Add directly on the Comptometer, the items as posted in the "Stock Ledger."

STOCK LEDGER			
Brought Forward	Amount	Brought Forward	Amount
	32.46		84.26
Date		Date	
1	14.7	11	3.57
	3.26		7.46
2	2.27	12	8.32
	4.81		7.46
3	8.40	13	4.33
	4.15		5.16
27.43		32.21	
	84.25		152.76

Then add the "Commodity Totals" from the backs of the Requisitions and prove against the total of "Stock Ledger Postings." Post this daily total to the "Controlling Account."

## MONTHLY STOCK CARD INVENTORY OF MATERIAL USED

This method, being adopted by some roads, employs only the "Stock Cards" and "Monthly Commodity Inventory" sheets for the records.

The quantities used and prices are abstracted to the "Commodity Inventory Stock Ledger Sheet" from the "Stock Cards."

### COMPTOMETER WORK ON INVENTORY SHEET

Hold the rate .0375 for Key Factor over Fixed Decimal and multiply the quantity, 1726 = \$64.73, etc.

Add the Extensions 64.73, 8.95, etc. = 2116.95.

Prove by extending, accumulatively, over Fixed Decimal,

$$1726 \times .0375$$

$$185 \times .0484, \text{ etc.} = 2116.95$$

This work involves thousands of calculations. The relief afforded and the accuracy assured by the Comptometer makes it thoroughly appreciated by the Storekeeper and the Clerks.

### PHYSICAL INVENTORIES

The physical inventories are usually taken semi-annually. The Comptometer work is practically the same as the foregoing.

### SIGNAL ENGINEERS

Signal Engineers have charge of the Signals and "Block Systems." The accounting work of the Signal Engineer consists mainly of figuring and proving Requisitions for materials, determining "Unit Costs," keeping the Ledger Accounts and Payrolls.

See "Storekeeper" for the identical class of Comptometer work. Some roads have this accounting done by the Storekeeper.

INVENTORY STOCK LEDGER						
BUILDING	FLOOR	DEPT.	LOCATION	ACCOUNT	SHEET NO.	
34	1	Lumber	B.C.	22	31	
QUANTITY	STOCK CARD NUMBER	ACCT. No	RATE	PER	EXTENSION	TOTAL
1726'	1367	22	.0375	ft.	64 73	
185'	1368		.0484	"	8 95	
642	1369		.05123	"	32 89	
964	1370		.05162	"	49 76	
753	1372		.0175	"	13 18	
1920	1567		.0192	"	36 98	
16507	1589		.0475	"	784 08	
					1126 38	
						2116 95

# **STOREKEEPER'S BALANCE SHEET**

This is a summary of the Stock Ledger Accounts, and is abstracted directly from the Stock Ledger. The total values for the month being used.

## **METHOD**

Cross-add disbursements, 1022.85, 511.42 = \$1534.27.  
 (This column of cross totals is not shown)  
 Cross-add all Stock values, 1765.40, 900.60, and 43.50 = \$2709.50.  
 Leave this in the register and subtract the cross total of disbursements, 1534.27 = The net value, \$1175.23.

Proceed in the same manner for each commodity.  
 Add all vertical columns.  
 Cross-add and balance the totals in the same manner as the commodities.

### TIE AND TIMBER AGENT

This work is usually connected with the Purchasing Department or Storekeeper.

The Lumber Bills are particularly adapted to the Comptometer, because of the hard and tedious calculations. In fact, the **Direct Acting Key Driven Machine** is the ideal for this type of work.

The principal uses for the Comptometer are:

Proving Daily Postings,  
Balancing Accounts,  
Making up Trial Balances,  
Stock Cards,  
Monthly Inventories,  
Averaging Prices,  
Figuring and Proving Requisition Slips.

#### EXAMPLE 1.

17 Pieces of Hardwood,  $4\frac{1}{2} \times 6\frac{1}{2} \times 16 = 663'$ . At \$57.40 M. = \$38.06.

#### METHOD

Multiply the thickness by the width, i. e.,—

Hold 4.5 at right of Keyboard and multiply 6.5.....	= 29.25
Leave this in the machine and multiply by length, 16, (3 Factor Way).....	= 468.
Continue and multiply by number of pieces, 17 (3 Factor Way).....	= 7956.
Continue and divide this result by 12.....	= 663 ft.
Clear the machine and multiply by price at right of Keyboard, $.663 \times 57.40$ .....	= \$ 38.06

#### EXAMPLES 2 AND 3.

1745 Ties at  $.95\frac{1}{2}$  each..... = \$1666.48

74540' of Pine at \$37.50M..... = ~~2795.35~~  
2795.25

Hold the Prices for Key Factors and multiply over the Fixed Decimal or from the right of Keyboard.

For details of these forms see "Storekeeper."

# CLAIMS

The Claim Department has charge of all settlements for claims on over or short weights, losses, damages, etc.

## Prorating Claims

The Claim Statement covers all data re the claim, including the roads responsible and the basis of settlement.

### Prorate Claim No. 1 on a Mileage Basis

The shipment was hauled 202 miles over the B. & A.  
294 miles over the N. Y. C.  
540 miles over the L. S. & M. S.  
489 miles over the C. & N. W.

1525

## COMPTOMETER METHOD

The mileages are first inserted on Synopsis —  
Add the mileages, 202, 294, etc., for total = 1525.

### Find the Rate of Claim per Mile

Add the amount of damage, \$35.00, in the Comptometer at the left and divide by "Total Miles," 1525 = .02295 per mile.

### Prorate Each Road's Proportion

Hold the "Miles" for Key Factor, at right of Keyboard, and multiply the rate —

.02295 × 202 = \$4.64  
294 = 6.75  
540 = 12.39  
489 = 11.22

Add the Proportions, to prove against the amount of claim = \$35.00

### Prorate on Percentage Basis

The authorized percentages are inserted.

Prorate for each road's proportion.

Hold the rates for Key Factor, at right of Keyboard, and multiply the amount of claim —

\$36.75 × 46.4% = \$17.05 for C. C. & St. L.  
× 15.6 = 5.73 for Lake Shore  
× 38.0 = 13.97 for N. Y. C. & H. R.

\$36.75

and prove against the amount of the claim.

## ON MILEAGE BASIS

C.R. Form 107 - 100-9-10-13 V.M.

**PRORATING SYNOPSIS OF CLAIM**

Red Line Date Rec'd JUL 23 1913

Claimant's No. 32 Our No. P-383300

Claimant Phoenix Glass Co

Address Boston, Mass Nature Wgt & 35.00

Received from F. Pottingill No. 33221

Commodity Glass from Boston Mass Billed on Omaha Net W. R. 300 Date 7/1/13 Car 3214 842.

Previous Claims none

PRORATE	ROAD	PERCENTAGE	AMOUNT
	B&A	40.2	14.64
Boston to Omaha	N.Y.C. & H.R.	29.4	6.75
Rule 40	L.S. & M.S.	54.0	12.39
	C. & N.W.	48.9	11.22
		152.5	35.00

## ON PERCENTAGE BASIS

PROVE \$36.75 on Percentage

ROAD	PERCENTAGE	AMOUNT
C. C. & St. L.	46.4%	17.05
Lake Shore	15.6%	5.73
N.Y.C. & H.R.	38.0%	13.97
	100.0%	36.75

## COMPARISON WITH AND WITHOUT THE COMPTOMETER

CLAIM DEPT.

Distribution of loss based on mileage.

EXAMPLE OF MENTAL WORK:

Loss 6.74

Big 4 304 miles = .34370

L &amp; N 289 " = .32790

N &amp; C 292 " = .3390

885 " 1.0090

885) 304.0 (.343

2655

3800

3540

3100

2655

6.74

.343

2022

2696

2022

2.31182

2.32  
2.20  
2.22  
6.74

885) 289.0 (.327

2655

2300

1770

5800

6395

2022

2.20398

885) 292.0 (.33

2655

2650

2655

6.74

.327

4718

1348

2022

2.20398

6.74

.33

2.022

2022

2.2242

With pencil he makes 174 figures and takes 3 to 5 minutes time.

Loss \$ 6.74

Miles

Big 4 304

L &amp; N 289

N &amp; C 292

885

COMPTOMETER WORK.

← The Comptometer adds the miles.

885) 6.74 (.00762 ← Divides for rate per mile.

.00762 x 304 = 2.32

.00762 x 289 = 2.20

.00762 x 292 = 2.22

6.74

← Multiplies rate by mileage for each Proportion. Adds the Proportions to prove against the total claim.

With Comptometer he makes 17 figures. Time - about 55 seconds.

The illustration at the left shows a comparison between the old hand method of working up statistics in the Claim Department and the more efficient Comptometer method.

Not only does the Comptometer effect a valuable saving in time, but it also lightens the labor otherwise involved in jotting down so many figures by hand.



## RELIEF CLAIMS

These are small and unquestioned claims which are settled by the Local Freight Agent.

# THE TEXAS & PACIFIC RAILWAY COMPANY

## DETAILED STATEMENT OF RELIEF CLAIMS.

At *Dallas* Station *July* 1911

WAY-BILL		Expense Bill No.	Sta. Claim No.	Auditor's Claim No.
Date	No.			
5/6	369	419	142	1567
-	471	746	143	1582
5/8	576		144	1623
-	643		145	1645
5/10	657		146	1674
5/11	692		147	1699
5/13	712		148	1731
5/27	784		149	1749
7/2	921		150	1762
8/3	946		151	1792

.92 74

## COMPTOMETER WORK

Add the amounts, for verification, 2.67, 5.89, 1.64, etc. = \$69.44.

There may be one or more of these statements per month from each station.

In addition to the uses shown, the Claim Department has considerable general additions for the Comptometer.

### MONTHLY SUMMARY OF CLAIMS

The month's totals are abstracted from the Commodity Claim Sheets to a Summary, for the purpose of exhibiting the entire losses for the month.

CHICAGO, MILWAUKEE & ST. PAUL RAILWAY COMPANY									
FREIGHT CLAIM DEPARTMENT									
Statement of Loss and Damage Freight Claims paid during <i>July</i> 191 <i>5</i>									
		1 Wreck	2 Delay	3 Rough Handling, Bad Loading and Damage in Transfer	4 Engine Failure	5 Defective Equipment	6 Leaky Car	7 Improper Ventilation or Refrigeration	TOTAL
1 Packing House Prod.		31.60	5.00	45.70	77.90	45.00	21.00	170.65	397.45
2 Eggs, Butter, Cheese		115.65		76.045			670.70	670.70	2,187.65
3 Live Stock		490.65	49.60	70.60	190.65				801.50
4 Fruits and Veggies.		760.85	485.60	125.60	37.60		190.75	123.60	1,724.00
5 Beer and Liquors		890.60		460.25				70.65	1,421.50
6 Sewer Pipe		16.00		56.21					72.21
7 Boots and Shoes		8.70		10.65		160.00			179.35
8 Cement and Cem. Sacks		14.60		49.65		75.40	189.60		327.25
9 Hides and Pelts		5.60		7.45		170.60	73.40		257.05
10 Drugs, Oils, Paints		175.60	74.60	312.60			190.75	190.60	944.15
		986.40	325.75	485.75	225.16	183.75	340.10	476.55	3,025.46
TOTAL		3,496.25	941.15	2,284.95	531.31	634.45	1,676.30	1,673.20	11,337.60

#### METHOD

Add the totals of "Commodity Losses" for the Grand Total of Claims.

Add the losses in all commodities, for each cause —  
as, \$31.60  
115.65

490.65, etc. = \$3496.25, damage in wrecks.

Cross-add these totals \$3496.25, \$941.15 etc., and prove against the sum of the "Total" column, \$11,337.60.

#### CLAIM STATISTICS

(See following page)

The principal Claim Statistics to be worked up are:

Percentage of each commodity to "Total Claims";

Percentage of each cause to "Total Claims";

\* Commodity loss in each cause;

\* Cause loss in each commodity;

Percentages of Increase or Decrease over last month and corresponding month last year.

\* These two percentages are worked out from Summary Sheet, but are not shown here.

## CLASSIFYING COMMODITY CLAIMS BY CAUSES

The damages are classified into about sixty commodities. Each commodity is given a sheet or ledger page, on which the distributions are made by causes.

Fruits & Vegetables COMMODITY CLAIM SHEET							
CLAIM NUMBER	TOTAL	WRECK	DELAY	ROUGH HANDLING	ENGINE FAILURE	LEAKY CAR	IMPROPER VENTILATION
318	111.67	111.67					
320	216.50	216.50					
465	26.00						
920	116.70						
1645	68.00						
1728	115.25						
1926	157.50						
3014	187.00						
3168	374.15	374.15					
9073	98.05						
9840	116.49	116.49					
10564	57.63						
11728	50.17						
12945	216.00	216.00					
13746	49.06						
	4647.9	627.4	291.18	88.5	12.60	14.88	74.54
	1724.00	1608.5	485.60	125.60	37.60	190.75	123.60

## METHOD

Add the "Total Claims," \$111.67, 216.50, etc. = \$1724.00.

Add the items against each cause. A "wreck"—111.67, 216.50, etc. = 760.85.

Add the totals of the "Cause Classifications," \$760.85, 485.60, etc., = \$1724.00, proving against Total Claims, \$1724.00.

## COMMODITY STATISTICS

COMMODITY STATISTICS									
Commodities	Current Month	% Of Total Claim	Last Month	% Increase	% Decrease	Last Year.	% Increase	% Decrease	
Packing House Products	397 45	.0035	406 17		.0215	415 70		.0439	
Eggs, Butter, Cheese	2187 65	.0192	2065 42	.0592		2570 65		.2379	
Live Stock	801 50	.0071	760 48	.0539		940 73		.1480	
Fruits & Vegetables	1724 00	.0152	1728 45		.0023	1640 85	.5060		
	5282.85		5692.85			5936.92			
Drugs, Oils, Paints	944 15	.0125	780 60	.2095		940 76	.0064		
Total	11,337 60		11,433 97		.0085	12,745 60		.1104	
CAUSE STATISTICS									
Wreck	3496 25	.0308	3367 28	.0383		3765 28		.0716	
Delay	941 15	.0083	980 75		.0404	1076 40		.1257	
Rough Handling	2384 94	.0210	2466 70		.0328	2675 80		.1087	

The "Totals" for "Current Month," last month and last year are abstracted from summaries.

## COMPTOMETER WORK

Find percent of Commodity to Total Claim.

## METHOD 1

Divide the entire loss in each commodity by the "Total Loss." As the Divisor (Total of Claims), \$11,337.60, is a constant for all commodities, use the Reciprocal method and multiply; Get the Reciprocal to the fourth figure of 11,337.60 = 8820.

Hold 882 for Key Factor at the left of Keyboard and multiply the total for each commodity, —397.45 = .0035, 2187.65 = .0192, etc. See "Reciprocal Method," for pointing off.

Find percents of Increase and Decrease.

When figuring percents, it is customary in all Divisors over \$100.00 to disregard items of cents when below 50c, while 50c or over is called a full dollar.

Use "last month's" and "last year's" claims for the basis of percentages.

## Packing House Products:

Add "Current Month," 397.45 in the Comptometer at the left and divide by 406.17 = a negative percent, 9785, which subtract from 10000 = .0215% Decrease; or better, hold the cutoff at the left of .9785 and add over itself the negative for each key twice, small 784 = .0215%.

## Eggs and Butter, Etc.:

Add 2187.65 in the Comptometer at the left and divide by 2065.42 = 1.0592% or an increase of .0592%.

Continue in same manner for all commodities and cause percentage.

## METHOD 2

Add the larger amount 406.17 in the Comptometer at the left; subtract the smaller, 397.45 = 8.872.

Leave this difference in the register and divide by last month's total, 406.17 = .0215% decrease.

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**THE CLAIM RECAP.**

Each of the roads assessed is rendered an abstract of the Distribution Statement, showing the Claim numbers and the amounts proportioned against it for claims adjusted during the month.

The Comptometer work is the adding of the claim proportions.

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## REFUNDS ON CHANGES IN RATES

At times a Railroad will charge rates higher than have been authorized. The Railroad Rate Commission of the state will order some rates reduced and will make the ruling retroactive, covering a specified period of time. The Railroad may have to continue charging the higher rate awaiting the Court decision.

One Road has been ordered to refund the intra-state shippers the difference between the amount collected and that at the authorized rate for the period which the higher rate was collected. The Road must figure the amount of refund due the shippers.

The work is similar to the following:

16780lb @ .073 Cwt.	=	\$12.25 Amt. Collected
Authorized .058 Cwt.	=	9.73 Authorized
Refund	=	2.52

### COMPTOMETER METHOD

#### Find the Amount of Refund:

Add the amount collected, \$12.25, in the Comptometer over the Fixed Decimal. Then hold the negative of authorized rate, .058, (small .-57), for Key Factor, over the Fixed Decimal, and multiply the weight, 167.8 Cwt.

i. e., from original key position (small .-57), move to the right one place and then multiply towards the left. As you complete multiplying the 1 (19.2976 in the register), move to the left one column farther and subtract the weight, 167.8, which gives the refund, \$2.52.

#### To Prove:

Leave the above result, 2.5176, in the register and multiply the weight, 167.8, by the authorized rate, .058, over the Fixed Decimal. This will give the amount collected, \$12.25, and proves that \$2.52 is the correct refund.

This method of figuring absolutely proves the **correct amount of refund** whether or not there was an error in the amount originally collected.

The railroad referred to will, because of such a ruling, have about 350,000 claims — each claim will have from 1 to 50 or 100 expense bills attached — each expense bill will have from 1 to 5 or 6 such problems; on an average probably 3 problems per expense bill and 15 to 20 bills per claim, or about 16 to 20 million such problems to figure.

Inasmuch as there may have been an error in the original extensions at the higher rates, it would not always do to take the difference between the two rates, neither would it do to determine percentages, for the various changes and depreciate the amount collected, as neither would prove against an error in the amount originally collected.

## AUDITOR OF DISBURSEMENTS

The principal Comptometer uses in this department are:

To Verify Payrolls.  
Work Up Payroll Statistics.  
Verify Bills and Vouchers.  
Verify Master Car Builders' Bills.  
Prorate Expenses.  
Determine Miscellaneous Averages.  
Work Up Inter-State Statistics.

Make Journal Distribution.  
Figure Percentages of Increase and Decrease.  
Figure Depreciations.  
Figure Taxes and Insurance.  
Work up Fuel and Oil Statistics.  
General Ledger Work.

### Verify Payrolls

The Payrolls from all branches of the R. R. service come to the Auditor of Disbursements for verifying before paying. This may occur once a month; but many roads are adopting the semi-monthly plan. This work involves the verifying of thousands of extensions, additions and deductions in a very short period of time.

The Comptometer Method of verifying by accumulating soon becomes invaluable.

For Payroll Work, see "Division Superintendents."

### Payroll Analysis

The principal data required is:

The time and wages for each class of labor, as:

Conductors, Engineers, Firemen, Brakemen, Carpenters, Trackmen, etc.

The percentages of time and wages in each class of labor to the whole Payroll.

The percentages of Increase and Decrease in each class of labor.

### COMPTOMETER RECAPPING

Place the 10 Column Comptometer right beside the Payroll Sheets and add for each class of labor the days and hours of time on the left and the money on the right of Keyboard, continuing through all Payrolls to the total for each class of labor.

### Verify Bills and Vouchers

The extensions and additions on bills and vouchers for all departments are proven by the Auditor of Disbursements.

They will include all bills for Lumber, Rails, Fuel, Supplies, Car Repairs, etc.

### Comptometer Work

Hold the %, .175, for Key Factor over the Fixed Decimal and multiply the labor, 19.53=3.42. Jot this down, then add to it the Labor Cost, 19.53=22.95.

Continue in a similar manner for the other items.

Add the net extensions, 22.95, 92.23, etc.=195.63.

For proof of Total, add all items in detail; i. e., 19.53, 3.42, 50.09, etc.=195.63.

See "Storekeeper and Superintendent's" for other classes of billing.

COLLECTION BILL		Form 431.	
Indiana Harbor Belt Railroad Co.		August 31st, 1913	
F.O. Kelly Engineer Accountant, Cleveland, O.		GARY, INDIANA.	
To The Lake Shore & Michigan Southern Railway Co., Dr.		47635	
If further information required, Address Assistant Auditor, Cleveland, O. Remit to Local Treasurer, Cleveland, O.			
For Proportion of cost of repairing and operating Interlocker at Gary, Indiana, during June, 1913, as per agreement dated July 1st, 1901.		--Vis:--	
Repairs - Apparatus - Engine and Generator, Labor	19 53		
Supt. & Use of Tools, 17%	3 42		22 95
Signals, Repairs & Adjustments,	50 09		
1575 Ft. 10# Flexible Wire, 31.80-M-	28 40		
Labor.	78 49		
Add Supt. & Use of Tools, 17%	15 74		92 23
Renewals Acct. General Repairs, Switches & Connections			
34 pos. 8 x 10 x 10'-6" Oak Ties 29.00	99 08		
2380'	29 00		
50 Bolts	34		
	69 96		
Add 15%	10 49		80 45
Total			195 63

### Verify Master Car Builders' Bills

These are the bills for repairs to cars.

Verify on the Comptometer all extensions and additions; accumulate extensions where possible.

## PRORATING EXPENSE

There are many classes of expense items to prorate over the various road divisions. They are prorated on several bases, i. e., according to the Gross Earnings; Passenger Earnings; Train Mileage; Engine Mileage; Car Mileage, etc.

EXAMPLE:

LOUISVILLE & NASHVILLE RAILROAD COMPANY		
TRANSFER ENTRIES.		
And's Dist'to Department. <u>Hunkirk</u> Division,		
Month of <u>December</u> 190 <u>6</u>		
ACCOUNT	SUB ACCOUNT AND ITEMS	DEBIT
The following entry is made to charge each Division with its proportion of salaries, etc., of the Southern Weighing & Inspection Bureau, for the month of December, 1906, Prorated on basis of Gross Freight Earnings for the year ended June 30th, 1906.		
Amount to be prorated, \$4,567.40		
TO STAT'N SERVICE- MS1	7.56%	345 30
FREIGHT, MS2	4.83	220 61
C&N	.23	10 50
N&D	6.99	319 26
NFS	1.99	90 89
S&N	10.49	479 12
M&P	.60	27 40
BM	4.56	208 27
62.75		12866 05
100.00%		4567 40

## METHOD

Hold the percentages for Key Factors and multiply the prorating amounts, i. e., hold 7.56% at right of Keyboard and multiply 4567.40 = 345.30.

Hold 4.83% at right of Keyboard and multiply 4567.40 = 220.61, etc.

Add the prorated items to prove against the total amount prorated.



### WORKING UP PERCENTS FOR BASIS OF PRORATING

A Round House Expense of \$1465.28, charged against the freight and passenger accounts, is to be prorated on the basis of the Freight and Passenger Mileage.

DISTRIBUTION OF ROUND HOUSE EXPENSE BY SERVICES							
Service							
	Rev. Engine Miles		Service %		Expense	Distribution	
Div	Freight	Pass.	Frt. %	Pass. %		Frt.	Pass.
A	131893	40166	.7666	.2334	\$1465.28	\$1123.28	\$342.00
B	145760	95240	.6048	.3952	1742.65	1053.95	688.70
<p>Percentages may be assigned to each Accounting Division for the several classes of mileage, viz.—</p> <p>Rev. Frt. Train Mileage { Freight Pass.</p> <p>Freight Car Mileage</p> <p>Pass. " " etc.</p>							

First find the percent of engine miles in each service.

The Freight Engine Miles were 131893

The Passenger Engine Miles were 40166

Total.....172059

#### METHOD

##### Division A

Add the Freight Miles, 131893, in the Comptometer at the left.

Divide by the total, 172059 = 76.66% for Freight Mileage.

Clear and divide the Passenger Miles in the same manner = 23.34 % for Passenger Mileage.

Or—

Find the amount charged per Engine Mile and multiply same by the miles in each service.

i. e., Add Round House Expense, \$1465.28, in the Comptometer at the left and divide by total miles, 172059 = \$.0085161 per Engine Mile.

The percentage basis may vary a few cents from the mileage basis; as the latter will be carried out to the fifth or sixth decimal place.

## DISTRIBUTION OF EXPENSES

This work is in the Bookkeeping Department. When the **Expense Vouchers** are received and total amount of each voucher is entered, these amounts are again distributed to the accounts to which the individual items belong. There are usually 5 ledgers for the several classes of Expenses. Each Ledger will have 20 to 30 distribution columns.

										S
										Rail fastenings and joints
267	150.60					150.60				
268	1716.40			1716.40						
269	560.21							560.21		
270	728.64	728.64								
271	172.29									172.29
272	3170.42					3170.42				
273	512.66			512.66						
274	172.50			172.50						
275	31.85							31.85		
276	3170.42							3170.42		
277	560.21							560.21		
278	31.85	31.85								
279	194.60			194.60						
280	317.65					317.65				
281	218.00									218.00
282	570.62			570.62						
283	31.85	31.85								
284	570.62									570.62
285	172.29									172.29
286	3170.42					3170.42				
14,795.88 1,345.62 2,416.75 9,819.63 561.42 634.46										
27	314.60	2	137.95	5583.82	17	172.70	1	529.22	592.93	

## COMPTOMETER WORK

Add the Voucher Amounts, 150.60, 1716.40, etc. = \$27,314.62.

Add each class of distribution, 728.64, 31.85, etc. = \$2,137.95.

Cross add the distribution totals, 2137.95, 5583.82, etc. = \$27,314.62, which proves against the Voucher Total.

# DEPRECIATION

The railroads keep an account with each car, caboose, locomotive, etc. Each is charged with its cost of repairs and betterments.

Depreciated values are figured at stated periods or when the car goes out of commission.

## DEPRECIATION TABLES

Tables are made showing the depreciated value of

What was its value allowing a depreciation at 6% compound interest?

## METHOD

Look on the Table at the junction of 8 years and 7 months. You find the depreciated value of \$1.00 is .588235.

Hold the Car Cost, 875.00, for Key Factor and

DEPRECIATION TABLE—\$1.00 AT 6%.

Years		1 Mo.	2 Mos.	3 Mos.	4 Mos.	5 Mos.	6 Mos.	7 Mos.	8 Mos.	9 Mos.	10 Mos.	11 Mos.
1	.94	.995	.990	.985	.980	.975	.970	.965	.960	.955	.950	.945
2	.8836	.9353	.9306	.9259	.9212	.9165	.9118	.9071	.9024	.8977	.8930	.8883
3	.830584	.879182	.874764	.870346	.865928	.861510	.857092	.852674	.848256	.843838	.839420	.835002
4	.780749	.826431	.822278	.818125	.813972	.809819	.805666	.801513	.797360	.793207	.789054	.784901
5	.733905	.776845	.772941	.769037	.765133	.761229	.757325	.753421	.749517	.745613	.741709	.737805
6	.689871	.730235	.726566	.722896	.719227	.715557	.711888	.708210	.704549	.700880	.697210	.693540
7	.648479	.686421	.682971	.679522	.676073	.672623	.669174	.665725	.662275	.658826	.655377	.651927
8	.609571	.645237	.641995	.638753	.635511	.632269	.629027	.625785	.622543	.619301	.616059	.612817
9	.572997	.606523	.603475	.600427	.597379	.594331	.591283	.588235	.585189	.582139	.579091	.576043
10	.538618	.570132	.567267	.564402	.561537	.558672	.555807	.552942	.550077	.547212	.544347	.541482
11	.506301	.535926	.533234	.530542	.527850	.525158	.522466	.519774	.517082	.514390	.511698	.509006
12	.475923	.506301	.503770	.501239	.498708	.496177	.493646	.491115	.488590	.486053	.483522	.480991
13	.447368	.475923	.473544	.471165	.468786	.466407	.464028	.461649	.459270	.456891	.454512	.452133
14	.420526	.447368	.445131	.442894	.440657	.438420	.436183	.433952	.431716	.429480	.427244	.425008
		.418424	.416322	.414220	.412118	.410016	.407914	.405812	.403710	.401608	.399506	.397404

\$1.00 at the various rates of depreciation for any period by years and months.

## EXAMPLE:

Car No. 32416, original cost \$875.00, is destroyed after being in service 8 years and 7 months.

multiply .588235, preferably multiplying from left of Keyboard = \$488.46, value when destroyed.

Each road will have many problems of this nature. It may be found in the Shops' Office or Auditor of Disbursements.

## INTER-STATE COMMERCE STATISTICS

One phase of these statistics is the proportion which each item of the Classified Expense bears to the General Account or **Total Revenue** and also to the **Operating Expense**. Expense items will be distributed under the following classified headings:

Maintenance of Way and Structures.  
Maintenance of Equipment.  
Traffic Expenses.  
Transportation Expenses.  
And General Expenses.

Each classification may be divided into 10 to 30 Sub-Accounts.

The various amounts of cost are abstracted from the ledger.

### METHOD

Add the cost amounts, 77631.52, 37135.74, etc. = \$3288091.02, and prove against the ledger.

Find ratio to total of General Revenue Account, \$23,600,225.00.

In finding the ratio of each account to the Revenue, **each item of cost must be divided by the Revenue.**

Use the Reciprocal Method:

First find the reciprocal of the Revenue, 23,600,225 by dividing it into 1 = 42372.

Hold the Reciprocal for Key Factor, at the left

of the Keyboard (split the Key Factor, first using 423, then 72), and multiply the cost amount,

$77631.52 \times 423/72 = .33\%$  or decimal .0033.

$37135.74 \times 423/72 = .16\%$  or decimal .0016.

See "Reciprocal Work" for pointing off.

Continue in this manner for each item of expense and the total.

Add the items of per cents, .33, .16, 2.21, etc. = 13.93, which must prove against the per cent of the total, 13.93%

Work up percentages against the **operating expense** in the same manner.

## INTER AND INTRA-STATE DATA

Inter-state and Intra-state Data is worked up against all expenses in the same manner.

OPERATING EXPENSES STATISTICS													
ACCOUNT	JUNE, 1913			MAY, 1913			INCR.	DECR.	SAME MO. LAST YEAR			INCR	DECR.
1. Superintendence	77	631	52	78	986	40		.0171	75	190	61	.0324	
2. Ballast	37	135	74	41	216	37		.0990	34	164	73	.0870	
3. Ties	522	210	44	540	289	73		.0335	514	760	28	.0145	
4. Rails	95	765	40	90	173	40	.0620		91	746	37	.0438	
5. Other Track Mat.	198	765	40	202	164	85		.0168	178	164	67	.1156	

## TAXES

Figuring Taxes is an item of importance to the Railroads and involves much Comptometer work.

They figure State and County taxes and in each county, the taxes for schools, roads and other special assessments.

## EXAMPLE:

North and South Railway Co. has 37.46 miles in the State and 4.62 miles in Burr County. The value is \$67,000.00 per mile.

## The Tax Rates are:

State.....\$.96 a Thousand  
Funded Debt......23 a Thousand

1.19

County.....1.85  
School......36  
County Road......25  
Bond and Interest... .06

2.52

## EXAMPLE:

\$3.71 per \$1,000

**Find the Road Value**, both in the state and the county.

Hold the value, 67,000 for Key Factor and multiply the miles,

$37.46 \times 67000 = 2,509,820.00$   
 $4.62 \times 67000 = 309,540.00$

## METHOD

## Figure the Tax:

Hold the Tax rate for Key Factor over the Fixed Decimal and multiply the valuation —

For State..... $2509.820 \times .96 = \$2409.43$   
For Funded Debt... $2509.820 \times .23 = 577.26$

Leave the second extension, \$577.26, in the Register and add the first extension  $\$2409.43 = \$2986.69$ .

## To Prove:

Multiply valuation by the sum of the two rates,  
 $.96 + .23 = 1.19$ ,  
 $2,509.820 \times 1.19 = \$2,986.69$ .

## County Tax:

Work this up in the same manner:

$309|540 \times 1.85 = \$572.65$   
 $\times .36 = 111.43$   
 $\times .25 = 77.39$   
 $\times .06 = 18.57$

Add all extensions \$780.04

## To Prove:

Multiply valuation, 309|540 by the sum of the County Taxes,  $2.52 = \$780.04$ .

# MISCELLANEOUS AVERAGES

The Tons Moved, Tons Moved One mile, etc., and the various items of Operating Expenses are abstracted from other sources as the basis for figuring the Averages.

AVERAGES		Month of <i>July</i> 1912	
Landed Cars One Mile.		Empty Cars One Mile.	
601.15	36.368	9.77	4
604.78	51.578	13.86	4
715.62	6.449	1.73	4
500.04	13.194	12.55	4
758.24	20.514	5.51	4
818.28	29.809	9.08	4
118,357.78	16.732	14.60	4
78,123.67	11.022	2.10	4

Average Total Cost per Mile
Average Number of Loaded Cars
Average Number of Empty Cars
Per Cost of Loaded Car Miles to
Average Number of Tons per Train
Average Number of Tons per Train
Per Cost of Empty Miles to Tons

Wanted:  
Average Costs per Train Mile.  
Average Costs per 100 Net Tons One Mile, etc.  
And other averages as noted on Form illustrated.  
The same class of data is worked up for the Passenger Service.

## METHOD

### Figuring Average Costs per Train Mile

As each Operating Expense is figured per Train Mile, the Train Mileage, 617788, becomes the constant divisor for each.

Use the Reciprocal Method.

Divide 617788 into 1 = 161867 as Reciprocal.

Hold the Reciprocal, 161867, for Key Factor at the left of Keyboard (splitting, using first 161, then 867) and multiply the expense items separately. (See Reciprocal Method for pointing off.)

224601.15 × 161867 = 36.36 cents per Train Mile.

318604.73 × 161867 = 51.57 cents per Train Mile.

Continue in this manner with all Operating Expense items.

### Average Cost per 100 net Ton Miles

Find the Reciprocal for the Hundred Ton Miles,

2299119 = 43495 (use as 435).

Hold the Reciprocal, 435, for Key Factor and multiply each expense item,

224601.15 × 435 = 9.77 cents per 100 Ton Miles.

318604.73 × 435 = 13.86 cents per 100 Ton Miles.

Continue in same manner with all other Operating Expense items.

### The Average Cost per Estimated Loaded Car Mile

As there are but one or two divisions by any one factor, work up these averages by dividing direct.

The Total Cost, \$1240674.36, divided by the Loaded Car Miles, 11,319,822 = the Average Earning per Loaded Car Mile.

Add the Cost, \$1,240,674.36, in the Comptometer at the left and divide by Loaded Car Miles, using 5 figures of Divisor; i. e., use as 1132 = 10.96 cents per Loaded Car Mile.

### Average Number of Loaded Cars per Train Mile

Divide the Loaded Car Miles, 11,319,822, by the Train Miles, 617788, as 61779 = 18.323 Loaded Cars per Train Mile.

Determine the other averages in the same manner.

The 12 or at least 10 column Comptometer should be used for this class of work.

### PERCENTAGES OF INCREASE AND DECREASE

The amounts charged to the various Transportation Expense Accounts are abstracted from the Ledger for the current and previous months and corresponding month of previous year.

PERCENTAGE INCREASE & DECREASE OF TRANSPORTATION AND TRAFFIC EXPENSES									
TRANSPORTATION EXPENSES		JULY	JUNE	PER CENT		LAST YEAR		PER CENT	
				INCR.	DECR.	JULY		INCR.	DECR.
Superintendence	00	61,500.22	53,106.57	.1581		51,604.21		.1918	
Dispatching Trains—Dispatching	67-a	100,648.20	99,100.36	.0085		98,670.00		.0200	
Dispatching Trains—Interchairs, block and other signals	67-b	41,207.12	38,183.57	.0792		37,140.00		.1098	
Station Employee—Passenger	68-a	896,096.38	851,657.66		.0584	802,499.21		.1166	
Station Employee—Freight	68-b	630,402.48	561,741.23	.1222		565,746.89		.1143	
Washing and Gar Services Associations	00								
		247,861.40	200,194.81	.3134		232,791.97		.0633	
		247,469	200,291	.0120	.3049	24830	62	28	.0665

#### METHOD

Add the current month's abstracted expenses, 61500.22, 100648.20, etc. = 26,478,469.20. Prove against the Ledger totals.

#### FIGURING PERCENTAGES

The expenses for the previous month and year are used as the basis for figuring the percentages.

Divide the "Current Month" (July) expense by that of "Last Month" and "Last Year."

This gives the percentages of current month to last month and last year. The difference between this percentage and 100% is the increase or decrease, i. e., if the per cent is over 100, it is an increase; if under 100, it is a decrease.

#### PER CENTS OF INCREASED EARNINGS

Add the "Current Month" in the Comptometer at the left, 61500.22, and divide by "Last Month," 53107 = 115.81%; i. e., an increase of 15.81%.

#### WHEN THE EARNINGS SHOW A DECREASE

Make the division in the same manner, i. e., add the Current Month in the Comptometer at the left, 896096.38, and divide by the "Last Month," 951,657.66 = 94.16%, the complement of which, .0584, represents the decrease. To register the per cent of decrease, hold back the cut-off just at the left of 9416 and add its negative, small —415, twice directly over itself.

The 10 or 12-column Comptometer should be used on this work.



These are the bills for Repairs to cars owned by other roads. They show in detail the material and labor items applied to the car repairs.

The value of manufactured material must be footed; then the pounds are added and proven by commodities and extended by the rate. The total of all Debits is entered in the Debit Column; the Credits are extended and deducted for the net charge.

Form 787. 2-28-1916. (225 (4-28))

*East & West R.R.C.*

Address *Chicago, Ill.*

Bill No. *25742*

All foreign road repairs are recorded on these ledger sheets. Some railroads have hundreds of such invoices to make out each month.

Add and prove the value of Manufactured Material, 3.46, .78, 1.26, etc. = \$163.48.

Add and prove the quantities for each kind of material. Labor. Hours and Scrap Credits.

**Extend the quantities; i. e., hold the price for Key Factor over the Fixed Decimal and multiply the quantity.**

$$251 \times .03 = 7.53, \text{ etc.}$$

Cross-add the Extensions of Credits for Scrap,  
.15, .36, 1.53 and 1.83 = \$3.87.

Then cross-add the Values, 163.48, 7.53, 4.90, 10.99, etc. . . . . = \$294.80

Leave this in the register and deduct the Amount of Credits.....	3.87
--	------

**\$290.93**

**To Prove:**

Extend the Credits over the Fixed Decimal,  
accumulating to total = \$3.87

Clear and extend the Debits in same manner and add to it the value of Manufactured Material, 163.48...	\$294.80
--	----------

**Then deduct the Credit..... 3.87**

<b>Equals the Net Charge.....</b>	<b>\$290.93</b>
-----------------------------------	-----------------

Thus proving every calculation.

										FORM 227, 3-28-1901-141. (GDS 0488)											
<b>East &amp; West R.R.C.</b>										<b>Bill No. 25742</b>											
Address <b>Chicago, Ill.</b>																					
<b>To THE LAKE ERIE &amp; WESTERN RAIL ROAD CO. Dr.</b>																					
For REPAIRS TO CARS as per.....										Month of <u>June</u> 19 <u>03</u>											
Date	CAR		Location	DESCRIPTION OF REPAIRS	Value of Material	Cast Iron Lbs.	Wrt Iron Lbs.	Mall. Iron Lbs.	Steel Lbs.	Stails Lbs.	Brass Lbs.	Zinc Lbs.	Paint Lbs.	Lumber Ft.	Labor Hrs.	CREDIT FOR SCRAP					
	Initial	Number														Cast Lbs.	Wrt Lbs.	Mall. Lbs.	Steel Lbs.	Brass Lbs.	Zinc Lbs.
4-28	G2W	3104U		Journals	3.88		16		9		16				5						2
"	"	"		" "	.78		18		14		2				19						1
5-2	"	4222P		Beam	1.50		3		37		4				21						6
"	"	"		Axle	9.46				64						6						4
5-6	"	3224		Wheel	8.75		5		21		21				7						17
5-13	"	5254R		Rear End	21.60				17						21						16
"	"	"		Door	1.60		21		37		16				64						20
"	"	"		Coupler	31.40		19		4						17						31
"	"	"		Pn. Beam	6.73		27		9						28						14
"	"	"		Journals	6.8				28		37				16						12
5-30	"	20342		Pn. Shreq	14.50		28		31						14						
"	"	"		" "	2.16		14		18						2						
"	"	"		" "	17.28		17		17												
					49.50		153		31		96				178						27 1/3
Correct:					Quantity.		257		140		283				318						100 61
					Price,		.03		24 3/4		.08				24						04.08
Approved: _____ Master Mechanic					Value,	163.40		257		140		283			76.82						1534.83
Approved: _____ Supt. Motive Power															Total Debit,	\$294.80					
Approved: _____ Gen'l Supt.															Total Credit,	3.87					
Audited: _____ Auditor															Net Charge,	290.93					
															Local Treasurer						
															\$ .						

Please remit to Local Treasurer, Indianapolis, Ind.

**GENERAL LEDGERS**

For the Ledger Work, see "Bookkeeping."

The Comptometer is placed right beside the work for all the Additions, Proving of Postings, Balancing Accounts and Trial Balances.

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## DIVISION SUPERINTENDENT

The Division Superintendent has the supervision and direction of all operations of his "Division" of the road. This may cover from 50 to 400 miles.

### The Uses for the Comptometer are Mainly:

Working up and proving Payrolls for all employees on his "Division," i. e.—

- Freight Agents and Clerks.
- Freight Handlers.
- Conductors and Brakemen.
- Engineers and Firemen.
- Signal and Switchmen.
- Section Hands.

Ledger Expense Accounts.

Making "Joint Bills."

Train Operating Statistics.

Percentage of Increase and Decrease.

### PAYROLLS

These are treated in the same manner as described under "Storekeeper" and "Shop Accountant."

### LEDGER EXPENSE ACCOUNTS

These consist of all Track and Transportation Expense accounts, and are handled in practically the same manner as in general "Bookkeeping."

### With the Comptometer:—

Prove all extensions and additions on Invoices for Material supplied the Division.

Add and balance all expense accounts.

Add balances of all accounts for "Monthly Balance Sheets."

### JOINT BILLS

A "Joint Bill" covers Items of Station and Track Expense, etc., where used jointly by two or more roads.

JOINT BILL.				
—				
NORTH & SOUTH LINE.				
TO EAST & WEST LINE, DR.				
On account of services performed at Gary station.				
Quant.	Material	Price	Unit	Amt.
25	E 7356 B0 Cock Levers	.25 1/2	ea.	\$ 6.38
50	5 1/4 x 10 Dust Guards	.15	ea.	7.50
15#	Curled Hair	.47	lb.	7.05
10#	#11 Spr. Wire	.03 1/2	lb.	} 2.10
50#	#5 Spr. Wire	.03 1/2	lb.	
6#	#14 Copper Wire	.207	lb.	1.24
284 yds.	Duck	.20	yd.	56.80
60 yds.	Enam. Duck	.35	yd.	21.00
400	Wick Feeds	.30	c.	1.20
210	1/2 x 10 Water Glasses	.52	doz.	9.10
24	#2 Filling Plugs	.23	ea.	5.52
2	#139 Sanders	12.50	set	12.50
40	Gauge Cock Gaskets	.07	ea.	2.80
				\$133.19
North & South Line, 27.6%				\$ 36.76
East & West Line, 72.4%				96.43
				\$133.19

### METHOD

Extend each quantity by the price.

Add the results.

Prove by accumulating Extensions.

Prorate on the authorized percentages.

Other Invoices will be such as for Icing Charges, Light, Heat, Water, etc.

## PAYROLL

The figure work on the "Payroll" is one of the most important duties of the Local Superintendent. Many States require the Railroads to pay twice a month, which has largely increased their payroll work.

**Office and non-productive** help, such as foremen, superintendents, etc., are usually paid by the hour, day or month.

**Shop help** are paid by the hour or on the piece or premium system.

**Enginemen and trainmen** are paid by the mile and trip, with hours and minutes for overtime.

For Monthly Basis—see "Payroll Work."

For Hourly Basis—see "Payroll Work."

For Hour and Min.—see "Payroll Work."

For Premium—see "Payroll Work."

### DIVISION SUPERINTENDENT, ENGINEMEN, FIREMEN, TRAINMEN

The rate of pay for this class of workmen is usually based on the mileage, according to the class of service and the size of the engine.

Some rates are by the trip and some by the hour.

#### EXAMPLE:

John Doe is credited with—

460 miles	@ 4.40 per 100 miles
523 miles	@ 5.20 per 100 miles
125 miles	@ 5.15 per 100 miles
3 trips	@ 2.85 per trip
14 Hrs.	@ .36 per Hr.
418 miles	@ 3.55 per 100 miles

\$82.30

Hold the Rates for Key Factors over Fixed Decimal; multiply towards the right, **accumulating to Total Wage,**

$4.60 \times 4.4.$

$5.23 + 5.20 \text{ etc.} = \$82.30$

Prove in same manner.

If the individual extensions are required, for distribution to separate accounts, extend each item separately and jot down the answers,

$4.60 \text{ mi. @ } 4.40 \text{ per C} = \$20.24$

$5.23 \text{ mi. @ } 5.20 \text{ per C} = 27.20 \text{ etc.}$

Add the extensions for total.

Then accumulate for proof.

# PAYROLL TABLE FOR RAILROAD DIVISION SUPERINTENDENT'S OFFICES

The pay is by the month. The month may be 28, 29, 30 or 31 days, the smallest division of pay being for one-half day.

TABLE SHOWING DECIMALS OF A MONTH BY DAYS. 1/4, 1/2, and 3/4 of a Day.							
26 Day.	27 Day.	28 Day.	29 Day.	30 Day.	31 Day.	32 Day.	33 Day.
1 .0388	.0370	1 .0387	.0383	1 .0323	.0323	1 .0323	.0323
2 .0769	.0741	2 .0714	.0667	2 .0645	.0645	2 .0645	.0645
3 .1153	.1111	3 .1071	.1000	3 .0968	.0968	3 .0968	.0968
4 .1538	.1481	4 .1429	.1333	4 .1290	.1290	4 .1290	.1290
5 .1923	.1852	5 .1786	.1667	5 .1613	.1613	5 .1613	.1613
6 .2308	.2222	6 .2143	.2000	6 .1935	.1935	6 .1935	.1935
7 .2692	.2593	7 .2500	.2333	7 .2258	.2258	7 .2258	.2258
8 .3077	.2963	8 .2857	.2667	8 .2581	.2581	8 .2581	.2581
9 .3462	.3333	9 .3214	.3000	9 .2903	.2903	9 .2903	.2903
10 .3846	.3704	10 .3571	.3333	10 .3226	.3226	10 .3226	.3226
11 .4231	.4074	11 .3929	.3667	11 .3549	.3549	11 .3549	.3549
12 .4615	.4444	12 .4286	.4000	12 .3871	.3871	12 .3871	.3871
13 .5000	.4815	13 .4643	.4333	13 .4194	.4194	13 .4194	.4194
14 .5385	.5185	14 .5000	.4667	14 .4516	.4516	14 .4516	.4516
15 .5769	.5556	15 .5357	.5000	15 .4839	.4839	15 .4839	.4839
16 .6154	.5926	16 .5714	.5333	16 .5161	.5161	16 .5161	.5161
17 .6538	.6296	17 .6071	.5667	17 .5484	.5484	17 .5484	.5484
18 .6923	.6667	18 .6429	.6000	18 .5806	.5806	18 .5806	.5806
19 .7308	.7037	19 .6786	.6333	19 .6129	.6129	19 .6129	.6129
20 .7692	.7407	20 .7143	.6667	20 .6452	.6452	20 .6452	.6452
21 .8077	.7778	21 .7500	.7000	21 .6775	.6775	21 .6775	.6775
22 .8462	.8148	22 .7857	.7333	22 .7097	.7097	22 .7097	.7097
23 .8846	.8519	23 .8214	.7667	23 .7419	.7419	23 .7419	.7419
24 .9231	.8889	24 .8571	.8000	24 .7742	.7742	24 .7742	.7742
25 .9615	.9259	25 .8929	.8333	25 .8065	.8065	25 .8065	.8065
26 .9630	.9286	26 .9286	.8667	26 .8387	.8387	26 .8387	.8387
27 .9643	.9300	27 .9300	.9000	27 .8710	.8710	27 .8710	.8710
28 .9657	.9333	28 .9333	.9333	28 .9032	.9032	28 .9032	.9032
29 .9671	.9355	29 .9355	.9667	29 .9355	.9355	29 .9355	.9355
30 .9677	.9371	30 .9371		30 .9371	.9371	30 .9371	.9371
1/2 Day .0096	.0093	1/2 Day .0089	.0083	1/2 Day .0081	.0081	1/2 Day .0081	.0081
1/4 Day .0192	.0185	1/4 Day .0179	.0167	1/4 Day .0161	.0161	1/4 Day .0161	.0161
3/4 Day .0288	.0278	3/4 Day .0268	.0250	3/4 Day .0242	.0242	3/4 Day .0242	.0242

31-day Month.

EXAMPLE:

24 days @ .....\$78.00  
 26 days @ ..... 78.00  
 28 1/2 days @ ..... 95.00  
 35 1/4 days @ ..... 90.00

## METHOD

Use the Fixed Decimal.

Hold the Rate for Key Position and multiply by the Decimal Equivalent of the Time, i. e.—

Multiply—

78 × .7742 (Decimal for 24) .....\$60.39

78 × .8388 (Decimal for 26) ..... 65.43

When fractions of days occur, a good plan is—

Hold the Rate.

Multiply by the Decimal Equivalent for the full days, and fraction of a day—

95 × .9033

× .0162

(The last multiplying position in the above was for the 4th decimal; therefore, hold the position and multiply by the 4th decimal for the fraction of a day, .0162, toward the left.)

95 × .9194 (Decimal for 28 1/2) .. \$87.35

90.00 × 1.1613 (Decimal for )..

× .0081 (1 Mo. & 5 1/4 days).. 105.25

\$318.42

### SUPERINTENDENT MOTIVE POWER

This office has the supervision of all locomotives and shops. Some of the forms worked up are:

Locomotive Record.  
Individual Engine Repairs  
Oil and Waste Expense.  
General Statistics and  
Locomotive Performance.  
Fuel Statistics.

#### LOCOMOTIVE RECORD (See following page)

This data is abstracted from the several original reports from the Shops, Round Houses, Car Accountant, etc. The data wanted from it is:

Monthly Cost of Repairs.  
Monthly Cost of Supplies.  
Monthly Cost of Fuel.  
Cost per 1000 Ton Miles, inclusive of Shop Repairs.  
Cost per 1000 Ton Miles, exclusive of Shop Repairs.

#### COMPTOMETER METHOD

##### January Data:

Cross-add on the right of Keyboard for the Total of each classification, i. e., Repairs, etc., 15.69, 73.80 = 89.49, etc.

Cross-add the Supply Costs, 10.60, 9.12, 360.75 and 91.60 = \$472.07.

##### Fuel.

Multiply Tons of Fuel, 151.7 by the price per ton, 2.21 = \$335.26.

##### Cost per 1000 Ton Miles, Inclusive of Shop Repairs

Add the Freight and Passenger Gross Ton Miles on right of Keyboard, i. e. ....	795600
	84600
	<u>880200</u>

Jot this on a pad.

Clear, and add the "Grand Total Cost" in the Comptometer at the left, ..... 896.82 and divide by the "Thousand Ton Miles," 880.200 = 1.02, cost per 1000 Ton Miles, including Shop Repairs.

##### February Data

##### Exclusive of Shop Repairs

Clear, and add in the Comptometer, on the left, the "Grand Total Cost" .....	1569.53
Subtract out the Shop Labor .....	<u>490.28</u>

= 1079.25

Then subtract the Shop Material .....	<u>373.90</u>
---------------------------------------	---------------

= 705.35

Divide directly by the "Thousand Ton Miles," 489.000 .....	= 1.44
---	--------

Cost exclusive of Shop Repairs.

##### General:

Add the monthly items for each expense, Labor, Material, etc.

Cross add for Classified Totals, and figure the yearly costs per 1000 Ton Miles.

## LOCOMOTIVE RECORD

N-10-19-8000											
CHICAGO, MILWAUKEE											
LOCO											
CLASS <u>K.1</u>											
Month	Shop Record		REPAIRS						Lubricants	Other Supplies	Wages of Enginemen
	Date In	Date Out	RUNNING		SHOP		Total				
			Labor	Material	Labor	Material					
January			15 69	73 80			89 49	10 60	9 12	360 75	
February			47 25	16 45	490 28	373 70	1076 28	264	4 15	172 90	
			374.06	1,174.61	2,378.46	1,834.27	5,761.40	81 93	68.74	1,843.72	
December			45 03	2 7 17			72 20	11 42	89 6	360 20	
Total			482 03	1,440 43	2,868 74	2,208 17	6,999 37	109 39	90 97	2,230 57	

F. D. 15											
& ST. PAUL RAILWAY COMPANY											
MOTIVE RECORD											
Enginehouse Expenses	TOTAL		FUEL		GRAND TOTAL	GROSS TON MILES		COST 1000 TON MILES			
			Price	Cost		Freight	Passenger	Exclusive Shop Repairs	Inclusive Shop Repairs		
91 60	472 07		151 7	325 26	896 52	795 600	84 600	1 02			
49 75	235 44		116 7	257 91	1569 63	472 400	162 00	1 74		32 4	
<i>746.322,740.51 1,178.4 2,604.26 11,106.17 6,1752.00 534,700 .98 1.58</i>											
83 18	453 96		149 4	230 17	866 13	766 600	83 400	1 02			
970 65	3,901 78		1,596 2	3,527 60	14,428 7	8,499 100	718 900	1 01		1 57	

## CAR LUBRICATION

The quantities of oil are abstracted from the Records.

Information Wanted is:

The miles run per pint of oil used by Oilers and by Trainmen.

The cost of the oil used by both the Oilers and Trainmen and the total.

The cost of the oil per 1000 miles by Oilers and by Trainmen and the total.

1 B R

193

MINEN

Galena Coach Oil—Pints, .0457	368		368				
" Car " " .026875	80	24	104	4007	1600	5607	
" " "							
Miles to One Pint Oil,	624	11629	592	627	1571	448	
Cost of Oil,	1895	64	1959	10769	4300	15069	
Cost per 1,000 Miles,	0678	0023	0701	0428	0171	0599	

METHOD

## Miles per pint of Oil—Oilers

Add in the Comptometer, at the right, the pints of oil in Passenger service, 368 and 80, = 448.

Divide the Passenger miles, 279,330 by 448 = 624 miles per pint of oil.

## Cost of Oil

Hold the Prices for the Key Factors. Use the Fixed Decimal method and multiply the quantities, accumulating to the total in each service, as:

$$368 \times .0457$$

$$80 \times .026875 = \$18.95, \text{ Oilers' Oil Cost in Passenger Service.}$$

## Cost per 1000 Miles

Add the cost, 18.95, in the Comptometer at the left and divide by the Thousand miles, 279.3 = \$.0678, Oilers' Oil Cost per 1000 miles.

In each case, continue in the same manner for oils used by Oilers, Trainmen and "Totals" for each service.

## Waste

The same data is worked up for Cotton and Wool Waste for both cars and Locomotives.



# LOCOMOTIVE AND CAR PERFORMANCE—OIL

The following items are abstracted from other sources:

Number of Locomotives,  
Mileage of Locomotives,  
Pints of Oil.

## LOCOMOTIVE OILS

### METHOD

#### Figure Average Locomotive Miles, Passenger Service:

Add the Locomotive Passenger Mileage, 39409, in the Comptometer, at the left, and divide by the number of Locomotives, 9 = 4378 miles, Average per Locomotive.

#### Figure Miles per Pint of Valve Oil

Add mileage, 39409, in at the left, and divide by pints of Valve Oil, 586, = 67.25 miles per pint of oil.

Add the Grease, Engine, Car Oil and Compound, 142, 739, 325, 33 = 1239.

Clear and add the Passenger miles, 39409, in the Comptometer at the left and divide by Pints Lubricating Oils, 1239 = 31.80 miles per "average" pint.

#### Figure the Cost of Oils

Hold the Prices for Key Factors over the Fixed Decimal and multiply the quantities, accumulating to the total,

$$586 \times .069$$

$$142 \times .45, \text{ etc.} = \$89.35, \text{ Cost of Oil in Passenger Service.}$$

#### Figure Cost per 1000 Miles

Add the Oil Cost, \$89.35, in the Comptometer at

NASHVILLE, CHATTANOOGA & ST LOUIS RAILWAY						
PERFORMANCE OF LOCOMOTIVES AND CARS						
Mechanical Dept.	Atlanta	Div.		Branch, Month of	April	
LOCOMOTIVES.						
	FREIGHT	EXPRESS	SWITCHING	WEEK-TONNAGE	AVERAGE	TOTAL.
	26		18	1		54
	91853		56326	777		196379
Average Miles per Locomotive.	4378	6533	2240		3525	
Galena Valve Oil—Pints.	0.069	• 586	1.6			
" " " "						
Miles to One Pint of Valve Oil.	67.25	61				
Grease—Pints.	142	• 142	32			
Galena Engine Oil—Pints.	0.063	• 739	2.9			
" " " "						
Car Oil—Pints.	0.0275	• 325	8.1			
" " " "						
Miles to One Pint Lub. Oil.	31.80	21				
Cost of Oil.	• 89.35	27.2				
Cost per 1000 Miles.	22.672	2.960		28.149	4.5045	3.7873
	50178	124970		77832	1200	
* Averages Not Included in Total						

the left, and divide by the Thousand Miles, 39.409 = \$2.2672, Oil Cost per 1000 miles.

Cross-add for the "totals" and prove against the sum of the service totals.

Proceed with each of the other services and the totals in the same manner.

## FUEL AND OIL STATISTICS

This phase of the work has been taken up under the head of Superintendent of Motive Power, although it is sometimes figured in the office of the Auditor of Disbursements.

## OIL AND WASTE DISTRIBUTION

The distribution is worked up on a percentage basis, i. e.,—

The percentage of miles each engine is operated in the several classes of service.

Use a 12-column Comptometer.

FORM No. 145—Is a record of all oils supplied the various engines for the month. The engine numbers are arranged in consecutive order. This sheet is made up by the Storekeeper.

FORM No. 1261—This contains the percentages of mileage performed by **each engine in each class of service**. These percentages are figured in the Car Accounting or Superintendent's Office. The engine numbers are arranged consecutively, so as to match up with Form No. 145, when laid side by side.

Form #145					Form #1261					
Eng. No.	Eng. Oil Pt.	Vlv. Oil Pt.	Car Oil Pt.		Eng. No.	Frts. %	Passr. %	Speci. %	Switch %	Work %
24	15	12	1		24			20		80
26	5	4	8		26			75	25	
27	9	9	15		27				83	17
35	-	5	-						95	5
40	5	8	-	5	18	96	2		1	1
41	20	2	5	-	27	19		13	42	26
27	8	10	-	7	25	100				
128	3	5	-	4	12	79	21			
271	-	-	-	3	3		100			
275	16	-	-	5	21		99		1	
415	-	10	-	-	10	3	97			
477	7	-	-	-	7	29			19	52
512	8	5	9	1	23	10	90			
	96	70	38	39	243	61.52	57.07	26.36	58.07	39.90

WANTED:—

The total units or quantities of all oil, grease and waste consumed on **each Division** in each class of service.

## METHOD

Cross-add all items of oils and grease for each engine, i. e.— Engine No. 24 —  $15+12+1=28$ , etc.

Add the quantities of each kind of oil, grease and waste, as Engine Oil, 15, 5, 9, etc.=96. (Waste is not shown on the form illustrated.)

To prove the additions—

Add cross-footings and balance against the sum of the vertical column totals.

## OIL AND WASTE—Continued

### FORMS 145-1261

Match the engine numbers. Slide Sheet No. 1261 under the right edge of No. 145 and have Freight Per Cent Column next to the Cross-Footing Total on 145.

#### Find the Total Units of Oils and Grease used in Freight and Passenger service

Figure both the Freight and Passenger at the same time. Use a 12-column Comptometer, with a single column Divisor, and Comptometer right beside the Oil Sheet.

Multiply the Freight Per Cents by the corresponding Total, i. e.—

Hold the Freight Per Cent, 96, for Key Factor, at the left of Keyboard, and multiply the Total Units, 18. Hold the Passenger Per Cent, .02, for Key Factor, at the right side of Keyboard, and multiply the Total Units, 18.

Continue in the same manner for each engine in the Freight and Passenger service, accumulating to the Total Units of Oils, etc., in each service; Freight 61.52 — Passenger 57.07 Units.

### SPECIAL SWITCH AND WORK SERVICES

These are very much lighter than the Freight and Passenger services; therefore, figure the "Special" on the left, "Switch" in center and the "Work" at the right of Keyboard—\$26.39, 58.07 and 39.98.

Carry these results to a Recap. Sheet. for all Divisions of the road. Cross-add the totals for each service —

61.52  
57.07  
26.36  
58.07  
39.98 = 243 Units.

Balance this against Total Oils, Form No. 145, which shows 243 Units of all oils combined.

DIVISION RECAP. OF OILS PER SERVICE						
Division	Freight	Passenger	Special	Switch	Work	Total
Hous. Main Line	61.52	57.07	26.36	58.07	39.98	243

### OIL AND WASTE—Continued

**To find the Approximate Cost of Oils and Grease in each Service.**

Eng. Oil costs .06483 per pint  
 Valve Oil costs .09632 per pint  
 Car Oil costs .02343 per pint  
 Grease Oil costs .0325 per pound

Multiply over the Fixed Decimal the pints of oils and pounds of grease by their costs, accumulating to the total.

.06483×96  
 .09632×70  
 .02343×38  
 .03250×39

243    \$15.12 Total Cost.

Hold the quantities for Key Factors over the Fixed Decimal and multiply towards the right.

**The Average Cost per Unit.**

Leave the cost, \$15.12, in the register and divide by the Total Units, 243 = .062222 Average.

Cost per Unit:

**The Approximate Cost per Service:**

Clear and multiply the units used in each service by this average price.

.062222×61.52 = \$ 3.83 Approx. Passgr. Cost  
 .062222×57.07 =    3.55 Approx. Freight Cost  
 .062222×26.36 =    1.64 Approx. Special Cost  
 .062222×58.07 =    3.61 Approx. Switch Cost  
 .062222×39.98 =    2.49 Approx. Work Cost

\$15.12

To get the **Absolute Cost**, work up each Oil in the same manner as we have the total.

# FUEL ACCOUNTING

Among the results wanted in Fuel Accounting are:

The Pounds Coal Consumed;

and the Cost per Ton Mile of Freight Hauled.

The "Wheel Report" furnishes the mileage and tonnage items for the "Daily Fuel Register." The "Coal Consumed" is taken from the daily loadingslips.

## METHOD

Determine the Average Tonnage of Each Train over the Division.

Add the Ton Miles, 279,200, in the Comptometer at the left and divide by the Train Mileage, 138, equals 2023, Ave. Tonnage for Train No. 37.

## Find Pounds of Coal Consumed per 1000 Ton Miles

Add the Pounds Consumed, 39,600, in the Comptometer at the left and divide by the Thousand Ton Miles, using the first decimal,  $279.2 = 141.8$  lbs. of Coal per 1000 Ton Miles for Train No. 37.

Galena Division DAILY FUEL REGISTER													
EAST BOUND TRAINS.													
MAIN LINE REVENUE FREIGHT TRAINS													
Train	Engine	ENGINEER	FIREMAN	CONDUCTOR	From	To	Actual Train Mileage	Load	Empty	Ton Miles	Average Tonnage of Train over Division	Pounds of Coal Consumed	Pounds of Coal per 1000 Ton Miles
37	506	Jones	Lee	McGee	Cal	Gal	138	50	3	279,200	2023	39,600	141.8
10	508	Smith	McGee	McGee	"	"	126	45	8	166,700	1323	34,000	203.9
94	512	Brown	McGee	McGee	"	"	116	49	1	241,600	2083	41,700	172.6
25	575	Wilson	White	Conkott	"	"	92	50	11	264,500	2875	37,700	142.5
32	586	Flaine	Smith	Jefferson	"	"	137	41	17	296,000	2160	38,700	160.7
103	594	McGee	Green	Thurman	"	"	145	16	71	257,600	1983	39,400	137.8
							737	253	113	1,535,900	2029	231,200	61
							1511	504	224	3,071,500	2033	462,360	121.54

## MONTHLY ENGINE RECORD

The data from the Daily Fuel Register is abstracted to this Monthly Engine Record.

## Totals

## METHOD

Add the items of Coal Consumed for the month, 39,600, 12500, etc. = 1427100 lbs.

Add the items of Ton Miles, 279,200, 113,000, etc. = 6,469,400.

## Average Pounds Coal per 1000 Ton Miles

Add the Pounds of Coal, 1,427,100 in the Comptometer at the left and divide by the total of Freight & Passenger 1000 Ton Miles,  $6,594.4 = 216.4$ , Average lbs. of coal per 1000 Ton Miles for the month.

1,427,100	567,000	5,100	500	1,341
1,427,100	567,000	125,000	511	2215
Average lbs. of Coal per Ton Mile, 216.4				

## FUEL ACCOUNTING—Continued

## MONTHLY STATEMENT OF TONNAGE HANDLED AND COAL CONSUMED BY ENGINEERS

A Record of the Fuel and Tonnage is kept for each Engineer, which provides data as to Fuel Economy of his engine.

The Train Miles and Ton Miles, Coal Consumed, and Pounds of Coal per 1000 Ton Miles, are abstracted from the "Daily Fuel Register."

CHICAGO, MILWAUKEE & ST. PAUL RAILWAY													
OFFICE OF FUEL INSPECTOR													
MONTHLY STATEMENT OF TONNAGE HANDLED AND COAL CONSUMED BY VARIOUS ENGINEERS													
ON <u>River</u> DIVISION FOR THE MONTH ENDING <u>July 31</u> 19 <u>13</u>													
TIME FREIGHT AND STOCK TRAINS					TONNAGE TRAINS				MONTHLY AVERAGE POUNDS COAL	PATROL AND WAY FREIGHTS			
ENGINEER	TRAIN MILES	TON MILES	POUNDS COAL CONSUMED	POUNDS PER 1000-TON-MILE	TRAIN MILES	TON MILES	POUNDS COAL CONSUMED	POUNDS PER 1000-TON-MILE		TRAIN MILES	TON MILES	POUNDS COAL CONSUMED	POUNDS PER 1000-TON-MILE
<u>F. B. Jones</u>	<u>138</u>	<u>2792.0</u>	<u>39600</u>	<u>1418</u>									
										<u>132</u>	<u>646</u>	<u>133</u>	<u>243.6</u>
	<u>126</u>	<u>101700</u>	<u>30500</u>	<u>299.3</u>	<u>126</u>	<u>1402</u>	<u>345</u>	<u>242.6</u>					
										<u>126</u>	<u>406</u>	<u>99</u>	<u>243.8</u>
	<u>126</u>	<u>87500</u>	<u>22000</u>	<u>251.4</u>									
	<u>93</u>	<u>78700</u>	<u>17800</u>	<u>226.2</u>									
					<u>113</u>	<u>1715</u>	<u>352</u>	<u>205.2</u>					
					<u>118</u>	<u>1739</u>	<u>376</u>	<u>216.2</u>					
	<u>483</u>	<u>547300</u>	<u>109900</u>	<u>200.8</u>	<u>357</u>	<u>4876</u>	<u>1073</u>	<u>220.1</u>		<u>258</u>	<u>952</u>	<u>232</u>	<u>243.7</u>

## METHOD

## Totals

Add each column of Train Miles, Ton Miles, Pounds of Coal and Pounds per 1000 Ton Miles for the Month's Totals.

## Pounds per 1000 Ton Miles

Add the pounds of Coal Consumed, 109900 in the Comptometer at the left and divide by the 1000 Ton Miles,  $547.300 = 200.8$  Pounds of Coal per 1000 Ton Mile.

Continue in the same manner for each class of trains.

\* These items should be read as hundreds, i. e.,—487,600 Ton Miles.

**FUEL ACCOUNTING—Continued****MONTHLY DIVISIONAL RECAP**

This particular illustration of Fuel Report is from a sheet containing about eight times the number of items shown.

The quantities are abstracted from Fuel Register to the Monthly Divisional Recaps. These records, as a rule, are worked up into "East-Bound" and "West-Bound" traffic by Districts and then the two consolidated. They require volumes of adding and percentage figuring.

**COMPTOMETER WORK**

Add the Train Miles, the Ton Miles and the Pounds of Coal Consumed for **Each District and Direction.**

**Figure the Averages**

Divide each item of Ton Miles by the Train Miles, as:

Add 3,433,900 Ton Miles in the Comptometer at the left and divide by 7050, Train Miles, equals 487, Average Train Miles for the Division.

Divide each item of Coal Consumed by the Thousand Ton Miles, as:

Add 1,377,100 in the machine at the left and divide by 3,433.9, equals 401.0 Average Pounds of Coal per 1000 Ton Miles.

Figure in the same manner Avg. Tons per train, and the pounds of coal per 1000 Ton Miles for each Train Mileage.

---

### COMPARATIVE PERFORMANCE OF LOCOMOTIVES

The Ton Miles for the Current and Previous Years are abstracted to this sheet, and the percent of Increase and Decrease is figured from same.

#### METHOD

The Increases or Decreases are based on the previous year.

The Percents are carried out to the 4th decimal; therefore use only the first five places of the Divisors.

Add the current year's miles, 5351541, in the Comptometer at the left and divide by last year's miles, 5053700 = 105.89%, or an increase of .0589.

Work up each of the other items in the same manner.

Add each group of miles for totals.

**Determine Cost per 1000 Passenger Ton Miles.**

#### METHOD

Divide the amount of each expense for the current month by the **Thousand Ton Passenger miles**, 147,-925.640. Not shown—in broken out part of form.

As this Divisor is constant, get its Reciprocal, =676 and multiply each expense item by same, as—Repairs;

4175.28 × 676 from left of Keyboard = .0282,  
Total Cost per 1000 Ton Passenger Miles.

Work up all cost items in same manner.

See "Reciprocal Method" for pointing off.

This data is worked up for Freight Service, Special and Switching Service, etc. Also worked up on the basis of Locomotive Miles in each Service. It entails seemingly an endless amount of adding and calculating.



# FUEL PERFORMANCE

The following shows another form of working up the Fuel Performances—

The Gross Ton Miles, Engine Miles, Tons of Coal, the average miles per hour and average hours per trip are given.

The data worked up on this sheet is:  
The lbs. of Coal per 1000 ton miles.  
The Engine Miles per Ton of Coal.  
The average weight of Train.

PRISCO LINES.								
March, 1913.								
FUEL PERFORMANCE THROUGH FREIGHT TRAINS.								
COAL BURNERS.								
Eng. No.	Gross Ton Miles	Engine Miles	Tons of Coal	# Coal per M Ton Miles	Engine Miles per Ton Coal	Avg. Miles Per Hour	Avg. Hrs. Serv ice per trip.	Avg. Wt. of Train
519	1,055,100	922	111	210	8.31	5.82	14' 2"	1144.36
521	1,765,200	1,509	192	217	7.86	8.10	12' 33"	1169.78
637	856,700	737	93	217	7.92	7.50	9' 53"	1162.41
638	1,841,200	981	116	126	8.45	7.80	10' 24"	1876.85
653	1,947,100	1,500	167	172	8.98	8.52	11' 20"	1298.06
655	2,262,500	1,366	165	145	8.27	7.98	13' 4"	1656.29
662	1,413,900	1,214	145	205	8.37	7.14	14' 6"	1164.66
1000	1,087,400	916	110	212	8.33	8.25	10' 16"	1132.53
1001	1,713,200	1,779	203	237	8.76	7.60	11' 20"	963.01
Tot.	13,882,300	10,924	1,302	187	8.39			1271.72

## COMPTOMETER RESULTS IN PEN AND INK FIGURES COMPTOMETER METHOD

### Coal per 1000 Ton Miles

Engine No. 519.

Reduce the 111 Tons to pounds = 222000 lbs. of coal used.

Divide by the 1000 Ton Miles, 1055.1 = 210 lbs. per 1000 Ton Miles.

### Engine Miles per Ton of Coal

Divide the Engine Miles, 922, by the Tons of Coal, 111, = 8.31.

### Average Train Weight

Divide the Gross Ton Miles, 1,055,100, by the Engine Miles, 922, = 1144.36.

Work up data for all engines in the same manner.

## SERVICE REPAIR COST BY ENGINES

The "Car Miles" in each service are abstracted from the "Individual Engine Record," the "Repair Cost" from "Shop Record." Wanted:—

The proportion of Repair expense for each class of service.

ADOPTED 8-00. Form 2531 S. 6043. 5 00. 3rd. 1 yr. (G.E.S. 88132)

**NEW YORK CENTRAL LINES**

*L S M S Ry* Co.

**STATEMENT SHOWING MILEAGE AND COST OF REPAIRS OF LOCOMOTIVES IN EACH CLASS OF SERVICE.**

On the *Franklin* Division, during the Month of *Sept* 19 *09*

ENGINE NUMBER	MILES RUN IN EACH CLASS OF SERVICE					COST OF REPAIRS	REPAIRS IN EACH CLASS OF SERVICE			
	Passenger	Freight	Working	Switch	Total		Passenger	Freight	Working	Switch
<i>5654</i>	<i>1286</i>		<i>265</i>		<i>1551</i>	<i>121.32</i>	<i>100.59</i>		<i>20.73</i>	
<i>4340</i>		<i>987</i>		<i>267</i>	<i>1254</i>	<i>25.90</i>		<i>20.39</i>		<i>5.51</i>
<i>4120</i>			<i>356</i>	<i>25</i>	<i>381</i>	<i>67.42</i>			<i>63.00</i>	<i>4.42</i>
<i>3501</i>			<i>456</i>		<i>456</i>	<i>119.25</i>				<i>119.25</i>
	<i>7566</i>	<i>10668</i>	<i>1883</i>	<i>2748</i>	<i>22865</i>	<i>1747.08</i>	<i>547.27</i>	<i>462.67</i>	<i>216.02</i>	<i>521.12</i>
	<i>8852</i>	<i>11,655</i>	<i>2504</i>	<i>3496</i>	<i>26,507</i>	<i>2080.97</i>	<i>647.86</i>	<i>483.06</i>	<i>296.97</i>	<i>653.08</i>

## METHOD

Cross-add the mileage for each engine, as 1286, 265 = 1551, etc.  
Add the total miles for each service, as 267, 25, 456, 2748 = 3496, etc.  
Add the "Service Totals" 8,852, 11,655, etc. = 26,507 and prove against the sum of the "Engine Mileages."

## Prorating Repair Cost to the various services

First determine the "Repair Cost" per mile for each engine,  $121.32 \div 1551 = \text{Repair cost per mile for Engine No. 5654.}$

## Or Better:

Use the Reciprocal Table:  
The Reciprocal of 1551 is 64475. Multiply this by 121.32 from the left of Keyboard, splitting the Key Factor,  $64475 = \$0.07822$ , Cost per Mile.

(See Reciprocal Method for pointing off.)

Clear and multiply this "Cost per Mile" by the Service Miles,  
 $1286 \times .07822 = \$100.59$  Passenger Service Repair Cost, Engine No. 5654.

$265 \times .07822 = \$20.73$  Work Service.

Leave the last item, \$20.73, in the Register,  
and add the previous proration, ..... 100.59

Equals Total Repair cost, ..... \$121.32  
thus proving the prorations for Eng. No. 5654.

Prorate each engine's Repair Cost to each service in the same manner.

Add the Prorated Costs for each service,  $100.59, 547.27 = 647.86$ .

Cross-add the totals 647.86, 483.06, etc., and prove against the  
Total Cost of Repairs ..... \$2080.97

## SHOP ACCOUNTING

Among the principal phases of this work are:

Shop Orders — Requisitions — Master Car Builder's Invoices — Payroll and General Statistics.

### SHOP ORDERS

A "Shop Order" is issued for authority to do certain work. All labor and material requisitions are charged against that "Shop Order" Number.

### REQUISITIONS

The Shop Clerk issues requisitions on the Storekeeper for materials. These requisitions are returned by the Storekeeper to the Shop Accountant, who then charges each item on material requisition to its proper expense account.

### EXPENSE ACCOUNTS

These accounts consist of the various items of expense, the car and engine, etc.

### METHOD

Post the items in detail from the requisitions to the expense account.

With the Comptometer placed right beside the Expense book,—

Add the extended items, posted to each Expense account.

### To Prove the Postings:

Drop a posting slip opposite each expense account as the postings are made. Then when the postings for the day are completed, add directly on the Comptometer the amounts posted and prove against the total amount of requisitions.

There will be hundreds of columns of this nature to add, ranging from a few items to full pages.

Or, if the detailed information is not required, add direct on the Comptometer, the amounts of the several requisitions for corresponding "Shop Orders" and post direct to the accounts.

Form 606. 2. 1917. 1-22. Rev. 1

Filed by *W. H. P.* Folio of Distribution Book *40*

Extended by *Col. L. L. Chap.* Storehouse.

Footed by *W. H. P.*

General Distribution of Material Book for the Month of *Jan*

PRICE	AMOUNT
	1.00
2.75	2.16
0.6	1.39
1.57	1.00
4.11	4.11
1.58	7.75
1.63	6.50
1.42	1.58
7.50	5.25
0.25	19.60
9.30	9.30
12.15	3.55
16.46	19.66
0.25	6.70
	111.23
	214.82

## SHOP PAYROLL

## PIECE WORK IN THE SHOPS

This is figured and proven in the Shop's office.  
The data is first recorded on "Daily Time Report."

PIECE WORKER'S DAILY TIME REPORT.						
NAME <i>Richard Roe</i>		DEPT. No. <i>Key</i>	CHECK No. <i>1021</i>			
DATE <i>10-11-10</i>						
PIECE WORK						
P. O. No.	ITEM	P. W. No.	No. PIECES	PRICE	HOURS	AMOUNT
	<i>Nuts</i>	<i>1641</i>	<i>13</i>	<i>3½</i>	<i>1</i>	
		<i>76031</i>	<i>34</i>	<i>8</i>	<i>7</i>	
		<i>70</i>	<i>16</i>	<i>2¾</i>	<i>1½</i>	
					<i>8</i>	<i>3.46</i>

## METHOD

Use the Fixed Decimal.

Hold the price for Key Factor and extend accumulatively.

$$\begin{aligned}
 13 \times .035 \\
 32 \times .08 \\
 16 \times .0275 \\
 = 3.46
 \end{aligned}$$

If the amount of each extension is required, extend over the Fixed Decimal and jot down each answer. Leave the last extension in the register and add the other items to it—or clear and add on the right side of Keyboard.

## CHECK ROLL

The Check Roll is merely the Time Book and covers the hours employed in each class of Labor, i. e., by the hour; by the piece; by the trip, etc.

## METHOD—Check #115

Enter the hours worked under their respective heads, Overtime, Day Work or Piece Work. Enter the "Piece Work or Premium" earnings daily.

## CHECK ROLL

Check No. <i>115</i>					Check No. <i>116</i>					Check No. <i>117</i>				
Name <i>J. J. Maloney</i>					Name <i>John Ross</i>					Name <i>James Flynn</i>				
Occupation <i>Bar Repair</i>					Occupation <i>Carpenter</i>					Occupation <i>Blacksmith</i>				
Date	Overtime	Day Work Hours	Piece Work Hours	Amount Earned Piece Work	Overtime	Day Work Hours	Piece Work Hours	Amount Earned Piece Work	Overtime	Day Work Hours	Piece Work Hours	Amount Earned Piece Work		
1		2	7	740		4	5	175		9				
2			4	5	150		5	4	150	2	9			
3	1	5	4	138	3	9			3	7	2	75		
4			3	6	225		3	6	210	6	9	125		
5	2	2	8	288		4	4½	163		9				
6			4	1	45		3	2	100		9			
7														
8		2	7	269		9				7	2	85		
9	3	3	6	229	2	9			15	9				
10			8	6	223		9			9				
11			3	6	212	15	9			8	1	31		
12			8	6	234		9			9				
13			5				5			9				
10 94 6 2201					97 3 12310 97 3 135									
Totals 16 123 68 2466 16 175 248 72 184 197 11 453														
Rate 54 36					60 40					52 35				
Total Amount 81 18					89 31					82 16				
Deductions 1 50					1 75					1 25				
Amount Payable 79 68					87 56					80 91				

With the Comptometer right beside the "Check Roll," add and prove—

The Overtime Hours	16	The Piece Work Hours	68
The Day Work Hours	133	The Piece Work Money	24.66
Accumulate the total earnings over Fixed Decimal, i. e.,			
Hold the Overtime Rate, \$.54, and multiply the Hrs. . . . .	16		
Hold the Hour Rate, \$.36, and multiply the Hrs. . . . .	133		
Add in the Piece Work Money . . . . .		\$24.66	
Equals . . . . .		81.18	
Subtract the Charges . . . . .		1.50	
Equals the Net Wages . . . . .		\$79.68	

The Check Roll for each workman is extended and proven in the same manner.

# PAYROLL SHEET

A summary is made of the "Check Rolls," called the "Payroll Sheet," and contains the totals of hours, trips, etc., the rates, extensions, deductions and net amount payable.

PAY ROLL SHEET																			
MEMO No.		NAMES		TIME AND RATE OF PAY								Total Amount Earned		Miscellaneous Charges		Relief Fund Contribution		Amount Payable	
				Hours	Rate	Trips	Rate	Days	Rate	Months	Rate								
115	J. J. Maloney	157	.36			P.W.	24.66					81	18			1	50	79	68
116	John Roe	200½	.40			P.W.	9.21					89	31	✓		1	75	87	56
117	James Flynn	221½	.35			P.W.	4.55					82	16	✓		1	25	80	91
1	John Jones	226	\$.37½		\$		\$		\$	\$	\$	84	75	✓		1	50	✓	83 25
2	Richard Doe.									1	75.	✓	75	00		2	25	✓	72 75
3	James Smith			16	2.93							✓	46	88	✓	1	90	✓	44 98
4	Will Mulcahy	196	.42½									✓	83	30	✓	2	25	✓	81 05
5	Henry Flanagan.	16	.27½	12	2.75	2	3.00					✓	43	40	✓	2	60	✓	40 80
6	James Brown.	45	.31			16	2.80					✓	58	75	✓	3	00	✓	55 75
7	Ed. Bilhars					P.W.	104.69					✓	104	60	✓	1	50	✓	103 10
8	Tom Bell.	28	.38							1	60.00	✓	70	64	✓	3	00	✓	67 64
												344	52			4	75	339	77
												1164	49			27	25	1137	24

## METHOD

With the Comptometer right beside the "Payroll Sheet":

Add the Wages earned, 81.18, 89.31, etc. = \$1164.49.

Add the Relief Fund Deductions, 1.50, 1.75, 1.25, etc. = \$27.25.

Add the Amt. Payable, 79.68, 87.56, etc. = \$1137.24.

Add Totals of Amounts Payable and Relief Fund Deductions, and prove against the Total Earned.

Prove these totals against the totals of "Check Rolls."

## VALUATION WORK

## INVENTORY

The "Physical Inventory" is taken by "Field Men" and sent in daily. The Pricing and Figuring are all done at the office.

Only a few of the many "Valuation Classification Inventory Sheets" will be illustrated.

R-9-12-1000		ENGR. 200	
Field Inspector <u>GWS</u>	Valuation as of <u>December 31<sup>st</sup> 1912</u>	In the State of <u>NY</u>	
Compiler <u>ALB</u>	Section Number <u>12</u>	<b>TIES</b>	
Checker <u>GCB</u>	Limits _____	Show each track, main and sidings separately. Show ties in joint track separately and indicate division of ownership.	

Location	Dimensions	Number Per Mile	CROSS TIES (State if ties are treated)			SWITCH TIES AND R. R. CROSSING TIES, INCL. HEAD BLOCKS (Show proportion of ownership of crossing road)								
			Oak		Cedar	Other Ties		Switch or Crossing	Kind	Pl. B. M. Per Set	No. of Sets	Price Per Set at Shop		
			Number	Price Ea. at Shop	Number	Price Ea. at Shop	Kind	Number	Price Ea. at Shop					
<u>Stg</u>														
<u>246+094</u>	<u>6'x8"</u>	<u>2650</u>	<u>4452</u>	<u>.81</u>	<u>32890</u>	<u>.56</u>	<u>Ham.</u>	<u>4026</u>	<u>.55</u>	<u>#10</u>	<u>Oak</u>	<u>2026</u>	<u>1</u>	<u>55.75</u>
<u>124+096</u>		"	<u>3294</u>	<u>.81</u>	<u>42670</u>	<u>.56</u>	"	<u>3028</u>	<u>.55</u>	"	"	"	<u>2</u>	"
<u>0384+948</u>		"	<u>4692</u>	<u>.81</u>	<u>1475</u>	<u>.56</u>	<u>Lam.</u>	<u>4327</u>	<u>.57</u>	"	"	"	<u>1</u>	"
<u>426+896</u>		"	<u>TREAT</u> <u>832</u>	<u>.92</u>	<u>8120</u>	<u>.56</u>	<u>Pine</u>	<u>206</u>	<u>.48</u>	"	"	"	<u>1</u>	"
			<u>1102652</u>		<u>85155</u>	<u>.47662</u>		<u>64497</u>						<u>218.75</u>

## METHOD

Extend each class on the right of Keyboard, accumulating to total.

## Oak Cross Ties.

$$4682 \times .81$$

$$3294 \times .81$$

$$4692 \times .81$$

$$832 \times .92$$

$$\underline{\$11026.52}$$

## Cedar

The Cedar ties are all at the same price; so add the quantities,

$$32890$$

$$42670, \text{ etc.}$$

$$= 85155$$

Leave this in the register and multiply by the price, .56, 3-factor way.

Proceed in the same manner for all other items.

# VALUATION WORK—Continued

## RAILS AND MILEAGE

Field Inspector GLAS Valuation as of December 31, 1912 In the State of NY  
 Compiler WLB Section Number 24 **RAILS AND MILEAGE**  
 Checker JCB Limits \_\_\_\_\_ Length of sidings to be head block to head block or to end of track  
 Show main tracks separate from spurs and sidings or yard tracks, leased lines, joint track with division of ownership

Location	Year	TRACK MILES							RAIL—TRACK FEET						
		Total Mileage	First Main Track	Second Main Track	Third Main Track	Fourth Main Track	Spurs and Sidings	Yard Tracks	Weight of Rail Per Yard						
									90 lbs.	85 lbs.	75 lbs.	65 lbs.	60 lbs.	56 lbs.	
ONE + 947	1910	.461	2436						1230		1206				
ONE + 096	"	.812		4259						1256	2000	1003			
0370 + 948	"	6.570	34687						1467	2438	1854	16024	13444		
0964 + 1220	"	.556	2936						236	1658	870	142			
Davenport	"	.032					170								170
"	"	.036					189								189
		8.467	40059	4259			170	189	2933	5412	5360	17169	13470	959	
							Gr. Tons		78.562	136.911	119.643	332.138	24060	5.953	
							Price		\$30.75	\$29.65	\$28.00	\$27.50	\$26.00	\$26.00	
							Am't		\$2415.78	\$4089.44	\$3850.00	\$9133.80	\$6255.78	\$113.56	

### METHOD

#### Find the Miles of Track:

Divide the feet of track by the number of feet in a mile, 5280, to determine the "Total Mileage." As there will be several divisions by 5280, get the Reciprocal and multiply.

The Reciprocal is 1894.

Multiply from the left of Keyboard by the various feet of Track-age. For pointing off, see "Reciprocal Method."

$2436 \times 1894 = .461$  miles.

$4289 \times 1894 = .812$  miles, etc.

Add the mileages, .461, .812, etc., for "Total Mileage" = 8.467 miles.

Add the Track Feet for each weight of Rails, separately; i. e., for 90 lb rail, 1230, 1467, 236 = 2933 ft., etc.

#### Prove Mileage and Track Feet:

Cross-add the Totals of Track Feet, 2933, 5412, etc. = 44707 ft.

Clear and multiply the Total Feet, 44707, by the Reciprocal for ft. per mile, 1894, as above, = 8.467 miles, proving both the Track Miles and the Track Feet.

#### Determine the Tons in each Rail Weight:

Double the feet of track,  $2933 \times 2 = 5866$  ft. 90 lb rail.

Hold the Weight per Yard, 90, as Key Factor at the right of Keyboard and multiply the rail ft.  $5866 = 527,940$ .

Leave this amount in the machine and divide by 3 (feet per yard) = 175,980 pounds.

Reduce to Gross Tons; i. e., divide by 2240 = 78.562 Gross Tons.

Instead of first dividing by 3, then by 2240, you may divide 527,940 by  $3 \times 2240$  or 6720 = 78.562 Gross Tons.

Or Better, make a Table showing the weights in decimals of a gross ton for each size of rail used. Take a rail weighing 90 lbs. per yard, for instance:

Add 90. in the Comptometer over the Fixed Decimal and divide by 3 (feet per yard) = 30% Wt. per foot of rail. As there are two rails for a track, multiply this weight of rail per foot, 30% by 2, i. e., add 30 in the Comptometer directly over itself = 60% Wt. per foot of track.

Leaving this result, 60%, in the register, divide it by 2,240 (lbs. per Gross ton) = .0267857 of a Ton per Track Foot.

Multiply the feet of track, 2933, by weight in tons per Track Foot, .0267857 = 78.562 Gross Tons.

Clear and multiply by Rate, \$30.75 = \$2415.78.

Continue in the same manner for each rail.

# **VALUATION WORK—Continued** **TRACK FASTENINGS AND OTHER MATERIAL**

Field Inspector <u>GLAS</u>		Valuation as of <u>December 31, 1912</u>		In the State of <u>N.Y.</u>	
Compiler <u>GLB</u>		Section Number <u>10</u>		Track Fastenings and other Material	
Checker <u>JCB</u>		Limits _____		Show items for each track, main and sidings separately Show joint track separately and indicate division of ownership	

Location	Length Feet of Track	Weight of Rail	SPICE BARS				ANTI-RAIL CREEPERS				BOLTS				NUTLOCKS			
			Kind	Number of Pairs	No. of Holes Per Bar	Weight Per Pair	Price Per Pair	No.	Weight Ea. in Lbs.	Price Per Pair	Size	No. of 20 Lb. Keys	Price Per Key	Kind and Size	No. Bought at 1912	Price Per Box		
<u>Davenport</u>	<u>2640</u>	<u>60</u>	<u>24"</u>	<u>828</u>	<u>4</u>	<u>37</u>	<u>.78</u>	<u>328</u>	<u>15</u>	<u>.14</u>	<u>7/8 x 1 1/2</u>	<u>2240</u>	<u>4.21</u>	<u>7/8 Spring</u>	<u>6.62</u>	<u>6.50</u>		
	<u>3746</u>	<u>85</u>	<u>Condyte</u>	<u>1146</u>	<u>4</u>	<u>68</u>	<u>1.45</u>	<u>624</u>	"	"	"	<u>2928</u>	"	"	<u>8.48</u>	"		
	<u>328</u>	<u>85</u>	<u>24"</u>	<u>112</u>	<u>4</u>	<u>80</u>	<u>.775</u>	<u>329</u>	"	"	<u>7/8 x 1 1/2</u>	<u>246</u>	<u>3.75</u>	"	<u>128</u>	"		
	<u>4267</u>	<u>90</u>	<u>Bangam</u>	<u>1428</u>	<u>4</u>	<u>74</u>	<u>1.62</u>	<u>1426</u>	"	"	<u>3/4 x 1 1/2</u>	<u>3128</u>	<u>3.65</u>	<u>3/4</u>	<u>9.40</u>	<u>6.40</u>		
							<u>4767.8</u>	<u>1907</u>			<u>238.98</u>		<u>340.95</u>		<u>163.81</u>			
<b>GRAND TOTAL</b>															<u>5451.32</u>			

## **METHOD**

Hold the prices for Key Factors over the Fixed Decimal and multiply by the respective quantities, accumulating to the total for each class.

Splice Bars — 828 @ .78  
 1146 @ 1.45  
 112 @ .775  
 1428 @ 1.62

**\$4707.70**

Prove in the same manner.  
 Cross-add for the Grand Total of the Sheet.

## **BRIDGES**

Field Inspector <u>GLAS</u>		Valuation as of <u>December 31, 1912</u>		In the State of <u>N.Y.</u>	
Compiler <u>GLB</u>		Section Number <u>27</u>		<b>BRIDGES</b>	
Checker <u>JCB</u>		Limits _____		Truss, Girder and I Beam Bents Includes overhead bridges and under grade crossings owned or leased by Railway Co., and identify as such Show joint ownership separately and indicate division of ownership	

Location	Bridge Number	Material	No. of Piers	PILING				FRAMED TIMBER				MASONRY				COPPER DAM			
				Kind	Total Lbs. Ft.	Net Ft. R.S.B.	Total Cost	Total Lbs. Ft.	Net Ft. R.S.B.	Total Cost	Kind and Class	Cu Yds.	Price Per Cu Yd.	Total Cost	Kind and Size	Total Cost	Total C. & S.		
<u>Davenport</u>	<u>X</u>	<u>X</u>	<u>4</u>	<u>2</u>	<u>Pine</u>	<u>4469</u>	<u>16</u>	<u>4469</u>	<u>4628</u>	<u>30.50</u>	<u>141185</u>	<u>Mass Concrete</u>	<u>4765</u>	<u>11.96</u>	<u>7128.04</u>	<u>X</u>	<u>X</u>		
"					<u>Oak</u>	<u>3647</u>	<u>74</u>	<u>2499</u>	<u>5298</u>	<u>29.05</u>	<u>14604</u>	"	<u>386</u>	<u>15.30</u>	<u>5905</u>	<u>X</u>	<u>X</u>		
"					<u>Oak</u>	<u>11694</u>	<u>75</u>	<u>33037</u>	<u>6270</u>	<u>30.97</u>	<u>19420</u>	"	<u>427.5</u>	<u>16.50</u>	<u>7053.75</u>				
															<u>20165.4</u>				

Each item is extended separately for further segregation.

## **METHOD**

Hold the prices for Key Factors and multiply each quantity from right of Keyboard.

Piling,  $4689 \times .86 = \$4032.54$   
 $3647 \times .74 = \$2698.78$ , etc.  
 Add for the total cost of piling.  
 Prove by multiplying accumulatively.  
 Work up each class of material in the same manner.



## STREET RAILWAYS, LOCAL AND INTERURBAN

## LOCAL

The Principal Phases of work to which the Comptometer applies are:—

Conductors' Trip Reports.  
 Daily "Route Records" of Passenger Receipts.  
 Recaps. for Month's Receipts.  
 General Summary of all Routes.  
 Superintendent's Daily Report of Cars and Trips.  
 Daily Statement of "Car" Receipts.  
 Traffic Statistics for the Month.  
 Comparative Statement of Operating Revenues.  
 Comparative Statement of Operating Expenses.  
 Income.  
 Comparative Balance Sheet.  
 General Statistics.  
 Payrolls.  
 Distribution of Payroll.  
 Voucher Register.  
 Voucher Distribution Record.  
 Cash Books.  
 Ledgers.  
 Storekeeper's and Shop Accounting.

## INTERURBAN

Same as above and:—  
 Conductors' Trip Report.  
 Local and Interline Ticket Reports.  
 Way-Bill Extension and Revision.  
 Consolidated Cash Report.  
 Monthly Abstracts of Way-Bills.  
 Monthly Statement of Uncollected Freight Bills.  
 Abstract Correction Summary.  
 Freight and Expense Balance Sheet.

## AT THE CAR BARN

Each Conductor makes out a Report detailing the Starting and Arriving time, Cash Fares, Tickets and Transfers, etc., for each trip made during the day, etc.

Equals 13.61.

This proves against the Cash turned in.

INTERNATIONAL RAILWAY CO							
RECORD OF PASSENGERS							
Nigam LINE							
DATE	D. M.	5C TICKET	5C CASH	5C CASH	TRANSFERS	OTHER FARES	TOTAL
1	87	431	5039	153	4016	3	9729
2	76	564	5075	165	3760	5	9645
3	86	460	4890	190	4175	2	9803
4	37	370	3780	145	3768	4	8113
531 8,985 102,174 1,024 95,127 10 207,851							
31	95	860	5786	248	4160	2	11171
TOTAL	912	11670	126753	1945	115006	26	256312
Camino 697950							

## COMPTOMETER WORK

Verify the addition for each class of Fares, Transfers, etc.

Cross Add the Totals for Total Passengers and balance against the Total of "Trip Passengers."

Extension:—

Hold the number of Cash Fares for Key Factor and multiply the rate, accumulating to the total.

## DAILY CAR AND TRIP REPORTS

COMPANY					
CARS USED AND TRIPS RUN					
June 1913					
No.	Trips	CAR MILES	Trips	CAR HOURS	
20	53	4986.14	25	535.50	
2	79	4464	25	6.67	
		493078		542.17	
17	89	2076.40	143	199.13	
16	41	4594.8	150	51.33	
7	24	329.28	48	31.50	
10	25	1744.2	105	18.42	
		3039.58		3003.8	
17	80	8592.0	140	80.00	
17	74	1153.10	136	104.00	
20	28	244.56	210	26.00	
		2256.86		210.00	

These reports are made up and forwarded to the General Office daily by the Line Superintendent

They contain the following data:

Number of cars operated; miles per trip and established time per trip.

Information wanted:

Car Miles, i. e., Total number of miles by all cars.

Car Hours, the number of hours service for all cars.

## METHOD

**Car Miles:**

Hold the number of cars, 238, for Key Factor and multiply the trip miles, 20.53 = 4886.14 Car Miles.

**Car Hours:**

Add the starting minutes, 15, at the right of Keyboard, then hold 60 and depress for each hour (2) = 135 minutes.

Hold 135 for Key Factor over itself and multiply the number of cars, 238 (135 is in the register once so count as one depression and make seven more

for first position) = 32130 minutes.

**REDUCE TO HOURS**

Leave in the register and divide by 60 = 535.5 Car Hours.

Continue in same manner for each line.

Add for the Total of each Route and for Grand Total.

These totals are brought to a recap., exhibiting the month's totals.

The Comptometer adds and proves all totals.

The accounting work is practically the same as for the Local work under "Railroads." The principal phases of additional work are found on the following:

This is a detailed statement or analysis of all tickets and cash fares collected. The Ticket Rates are printed on the form. The tickets are segregated and the number of collections is entered under each rate.

INTERNATIONAL RAILWAY COMPANY																																								
LOCKPORT & OLCOTT DIVISION																																								
CONDUCTOR'S TRIP REPORT—OFFICE COPY																																								
July 16, 1909																																								
LEAVE			TICKETS COLLECTED																				CASH FARES COLLECTED												CASH		TICKET		TOTAL	
TRIP	ORIGIN	TIME	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45		
1	B6	6:20	6	2	4	4								3		5	6	3	16	3	7	1	4	2	14									16	96	815	6 91	15 76		
2	74	7:40	26	2			12							1	1	2			7	11	5	2	9											17	96	585	5 74	11 69		
3	B6	9:40	15	1	6	7	12							1	2			5	1	3	2	1	1	1										12	80	160	7 81	9 41		
4	74	10:55	11	7	5	14								16		3	4	7	9	2	31	16	4	1	1	1								4	126	415	16 15	20 30		
			456	35	23	5	138							89	5	2	21	3	65	175	11	175	162	76	16	87	5	76					28	1599	7690	183 07	259 97			
28	B6	5:15	14	9	6	17								13		2		4	3	19	6	17	4	5										7	126	685	11 69	18 54		
			528	1	61	45	9	189						123	8	4	31	7	87	184	20	251	200	110	17	49	8	106						84	2122	104 20	231 37	338 57		

Hold the rates for Key Factors and multiply the corresponding number of tickets, accumulating to the **total ticket earnings** for the trip,  $6 \times 10$ ,  $2 \times 12$ ,  $4 \times 14$ , etc. = 6.91.

 $16 \times 5, 3 \times 10, 7 \times 15, \text{ etc.} = 8.85.$ 

**Work up earnings for each trip in the same manner.**

**Adding:**

**Cross-add for total passengers on each trip, 6, 2, 4, 4, etc. = 96.**

**Cross-add the Cash and Ticket amounts for the total,**

$$8.85, 6.91 = 15.76.$$

**Add tickets sold for the total at each rate, 6, 26, 15, etc. = 528.**

Add the "Passengers per Trip," 96, 95, 80, etc., = 2122.

**Add the Cash and Ticket earnings.**

**Cross-add these totals, for number of passengers carried,**

528, 61, etc. = 2122.

## TRIP REPORT RECAPS. BY LINES

This is an abstract of the totals of all of the Conductors' reports. It is made up daily and sent to the General Office.

Form 679 3-11-19000

**LINE RECAP**

**INTERNATIONAL RAILWAY COMPANY. RECORD OF PASSENGER RECEIPTS OF** June 1 1913

**COLLECTED ON** Niagara **LINE** Grace **STATION**

RUN NO.	PASSENGERS						Earnings	TOTAL PASSENGERS
	D. M.	5¢ TICKET	25¢ CASH	35¢ CASH	EMP.	TRANSFER		
300	5	45	240	16	4	75	14.73	385
301	16	37	263	5	9	106	15.15	436
302	5	16	128	1	1	153	7.23	304
303	1	18	313	2	3	162	16.61	499
304	4	37	164	6	4	185	10.23	400
<u>49 264 3746 106 16 3160 20368 7341</u>								
317	7	14	185	17	5	175	10.46	403
	87	431	5039	153	42	4016	278.09	9768

**COMPTOMETER WORK**

Add the number of passengers in each class, as 5, 16, 5, etc. = 87.

Add these totals, 87, 431, etc., for total passengers = 9768.

Cross add the passengers for each run, as run 300—5, 45, 240, etc. = 385.

Add the total passengers, 385, 436, etc. = 9768, proving against the Cross Totals.

Extend the total number Cash Fares by the respective rates, accumulating to the total which will prove against the cash—

$$\begin{aligned}
 &431 \times 5 \\
 &5039 \times 5 \\
 &153 \times 3 =
 \end{aligned}$$

\$278.09 Revenue from  
Niagara line for the day.

## MAKING UP THE GENERAL RECAP

Each line will have a Daily Recap of the Trip Reports

LINE RECAP									
INTERNATIONAL RAILWAY COMPANY RECORD OF PASSENGER RECEIPTS OF									
Collected on <u>Reagan</u> Line <u>Grace</u> Station									
DATE	NO. OF TICKETS	IN CASH	IN CASH	IN CASH	TRANSFERS	Earnings		TOTAL PASSENGERS	
						IN CASH	IN CASH		
3-1	5	45	240	16	4	75	14.75	355	
3-1	16	37	263	5	9	106	15.15	436	
3-2	5	16	128	1	1	53	7.25	306	
3-3	1	15	313	2	3	162	16.61	191	
3-4	4	37	114	1	4	155	10.23	411	
						49	241	3746	166
						16	316	20.36	7341
3-11	1	14	135	17	5	178	10.46	403	
1st	11	1131	5034	160	18	4116	915.09	9764	
2nd	11	1131	5034	160	18	4116	915.09	9764	
3rd	11	1131	5034	160	18	4116	915.09	9764	
4th	11	1131	5034	160	18	4116	915.09	9764	
5th	11	1131	5034	160	18	4116	915.09	9764	
6th	11	1131	5034	160	18	4116	915.09	9764	
7th	11	1131	5034	160	18	4116	915.09	9764	
8th	11	1131	5034	160	18	4116	915.09	9764	
9th	11	1131	5034	160	18	4116	915.09	9764	
10th	11	1131	5034	160	18	4116	915.09	9764	
11th	11	1131	5034	160	18	4116	915.09	9764	
12th	11	1131	5034	160	18	4116	915.09	9764	
13th	11	1131	5034	160	18	4116	915.09	9764	
14th	11	1131	5034	160	18	4116	915.09	9764	
15th	11	1131	5034	160	18	4116	915.09	9764	
16th	11	1131	5034	160	18	4116	915.09	9764	
17th	11	1131	5034	160	18	4116	915.09	9764	
18th	11	1131	5034	160	18	4116	915.09	9764	
19th	11	1131	5034	160	18	4116	915.09	9764	
20th	11	1131	5034	160	18	4116	915.09	9764	
21st	11	1131	5034	160	18	4116	915.09	9764	
22nd	11	1131	5034	160	18	4116	915.09	9764	
23rd	11	1131	5034	160	18	4116	915.09	9764	
24th	11	1131	5034	160	18	4116	915.09	9764	
25th	11	1131	5034	160	18	4116	915.09	9764	
26th	11	1131	5034	160	18	4116	915.09	9764	
27th	11	1131	5034	160	18	4116	915.09	9764	
28th	11	1131	5034	160	18	4116	915.09	9764	
29th	11	1131	5034	160	18	4116	915.09	9764	
30th	11	1131	5034	160	18	4116	915.09	9764	
Ych to 30th	193	7979	83045	598	3	30023	4569.14	165937	

INTERNATIONAL RAILWAY SYSTEM							
MONTHLY REPORT OF PASSENGERS, EARNINGS, MILES, CAR-HOURS AND PLATFORM-TIME							
BY LINES, DIVISIONS AND COMPANIES							
July, 1907							
Deadheads	5c Fares	1c Cash	1c Cash	Other Fares	Transfers	Total Passengers	Earnings
012	1470	126713	1044	24	115066	6214	61750

### COMPTOMETER WORK

The totals on the Daily Line Recaps are at the bottom of the sheets; therefore, arrange the sheets in the order shown so that the totals of each sheet are exposed. Then, with the Comptometer right beside the Line Recaps, add each column of Totals.

The various items, such as—  
 Dead-Heads— 87, 92, 95, etc., = 912,  
 5c Fares — 431, 455, 450, etc., = \$116.70,  
 and the other classes of Passengers, Earnings, etc., are added for the Monthly Totals.

## GENERAL RECAP.

The totals for all lines are now brought to a Grand Recap. exhibiting the total classified earnings for the road.

MONTHLY RECAP									
BUFFALO DIVISION									
Niagara	912.	11670	126753	1945	26	115006	250312	697950	
Main	1026	26740	146765	1645	11	171400	352587	872460	
Michigan	140	1675	12675	764	3	16461	31718	74042	
Main Zoo-Kenmore	195	1786	13760	864	16	19160	35721	80322	
Forest	36	560	1760	490	11	17170	10027	13070	
West Utica	1021	28765	141780	1716	44	187164	360494	857873	
	5716	101600	960700	5763	145	586740	1659664	5328789	
Lockport									
Kenmore-Grosvick	961	29740	195760	1640	16	296400	323521	1127420	
Total B'n. Lines-Int. Ry. Co.	9951	201536	1599953	14827	272	1403501	3230040	9051926	

## COMPTOMETER WORK

Add each class of passengers for the Division,  
as—Deadheads, 912, 1026, etc., = 9951.

5c Tickets, 11670, 26740, etc., = 201,536.

Cross add the several classes of passengers for  
each line.—e. g., Niagara Line, 912, 11670, 126753,  
etc., = 256,312.

Add the Total Passengers, 256,312, 352,587, etc.,  
= 3,230,040 and the earnings, \$6979.50, \$8724.60,  
etc., = \$90,519.26.

Cross add the totals for each class of passengers,  
9951, 201,536, etc., = 3,230,040.

The manner in which the Daily Line Recaps. are  
added to get the Monthly Totals for this General  
Recap. is illustrated on the preceding page.

## DAILY STATEMENT OF CAR RECEIPTS

The car miles and car hours are abstracted from the Daily Car and Trip Report. The Earnings are brought from the Daily Line Recap.

Information Wanted:

Divisional Totals.

Earnings per car mile and per car hour.

CHICAGO RAILWAYS COMPANY						NORTH DIVISION
DAILY STATEMENT OF CAR RECEIPTS SHOWN BY ROUTES						
FOR 26 June		1913. Weather 9 A. M. Fair			6 P. M. Fair	
ROUTES	CAR MILES	CAR HOURS	TOTAL RECEIPTS	PER CAR. MILE CENTS	PER CAR HR. C	RECEIPTS LAST YEAR
Clark to Rogers Park	4,931	543	1,425.00	28.90	2.62	1,376.45
Clark to Devon	8,040	300	1,042.75	34.30	3.48	965.40
Evanston Avenue--Howard	2,257	210	1,231.44	64.56	5.86	1,316.10
Southport Avenue	3,675	365	1,346.28	36.63	3.69	1,365.75
Through Route No. 1	3916	612	1,649.40	42.12	2.70	1,475.90
Through Route No. 22	5,175	675	1,948.75	37.66	2.89	1,767.48
Lines Discontinued						
TOTAL DEVON C. H.	22,994	2,705	8,643.62	37.59	3.19	8,267.08

## METHOD

Add and prove the Car Miles, Car Hours and total receipts.

## Earnings Per Car Mile and Car Hour

Add the earnings, 1425.00, in the Comptometer at the left and divide by the Car Miles, 4931 = 28.90 Earnings per car mile.

Add the earnings, 1425.00, in the Comptometer at the left and divide by the Car Hours, 543 = \$2.624 per car hour.

Work up the data for each route in the same manner.

## Postings:

From the Daily Statement post to the Ledger, the car miles, hours and total receipts.

Post from the Daily Line Recap to the Ledger, the earnings and the number of passengers carried.

Prove the Daily Postings with the Comptometer and the Posting Slips

See Bookkeeping.

Add Ledger accounts for all lines for Monthly Balances.

Each column will be 30 items deep.

There is an endless amount of this adding.

## LOCAL AND INTERLINE STATION TICKET REPORTS

The local agent turns in reports, daily and weekly or monthly, of all ticket sales. They show the commencing and closing numbers, the number sold and the respective rates.

## BUFFALO AND LAKE ERIE TRACTION COMPANY

## MONTHLY REPORT OF TICKET SALES.

For

*Fredonia*

Station

Month of

*June*

1913

## LOCAL TICKETS

Line	DESTINATION	Form	Highest No. on Hand	CONSECUTIVE NUMBERS		No. Sold	Rate	AMOUNT	
				Commencing	Closing				
1	Buffalo, N. Y.	<i>Exc</i>	<i>214</i>	<i>150</i>	<i>161</i>	<i>11</i>	<i>1.65</i>	<i>18 15</i>	
2	Lackawanna, N. Y.		<i>359</i>	<i>312</i>	<i>324</i>	<i>12</i>	<i>1.70</i>	<i>20 40</i>	
3	Blasdell, N. Y.		<i>399</i>	<i>345</i>	<i>366</i>	<i>21</i>	<i>1.85</i>	<i>38 85</i>	
4	Big Tree, N. Y.		<i>399</i>	<i>325</i>	<i>376</i>	<i>51</i>	<i>1.90</i>	<i>96 90</i>	
5	Scranton, N. Y.		<i>449</i>	<i>414</i>	<i>418</i>	<i>4</i>	<i>1.95</i>	<i>7 80</i>	
								<i>597 60</i>	
28	Hamburg-on-the-Lake, N. Y.		<i>549</i>	<i>501</i>	<i>516</i>	<i>15</i>	<i>2.95</i>	<i>44 25</i>	
29	Lake Side, N. Y.							<i>823 95</i>	

## COMPTOMETER WORK

Prove the number of tickets sold.

Add the number of tickets sold to the commencing  
number equals the closing number,

11  
150  
161

## Extensions

Hold the rates for Key Factors and multiply the  
respective number of tickets sold,

$11 \times 1.65$   
 $12 \times 1.70$ , etc., accumulating to the  
total \$823.95.

This proves the Local Agent's extension and  
addition at the same time.



## INTERLINE TICKET REPORT

This is practically the same as the Local Ticket report in the foregoing illustration.

Prorating Interline Earnings is practically the same as illustrated under "Passenger Auditor," Railroad Accounting.

## Daily Consolidated Cash Report

The net amount of earnings from each source, such as Cash Fares, Express, etc., are brought together on this report by Divisions. The Report exhibits the earnings from each source by divisions, the Total earnings for each Division and the total earnings from each source for the day.

									Net O. Profit	TOTAL
Hamburg	449.35	16.70	45.00	12.60	37.65	1.90	3.70	16.50	583.40	
Interurban	123.70	5.62	15.00	5.75	16.50	1.40	3.90	14.25	186.12	
Dunkirk & Fredonia	210.75	19.40	76.00	17.75	45.70	21.70	6.90	17.65	415.85	
Erie City	570.75	31.60	29.16	5.76	76.41	37.65	1.90	31.50	784.73	
Interurban East	495.64	81.70	49.62	3.16	105.60	12.70	3.70	40.60	792.72	
TOTAL	1850.19	155.02	214.78	45.02	281.86	75.38	20.10	120.50	2762.82	

## COMPTOMETER WORK

Add the amounts of revenue from each source, 449.35, 123.70, etc. = \$1850.19.

Cross-add these totals, 1850.19, 155.02, etc., and prove against the Grand Total, \$2762.82.

## PAYROLLS

The following represents a section of the Trainmen's Payroll. The minimum time recorded is 6 minutes. All minutes are entered as decimals of an hour as each 6 minutes is 1/10th of an hour. Thus 10 hours and 36 minutes is entered as 10.6 hours.

INTERNATIONAL RAILWAY COMPANY.										PAY ROLL OF TRAINMEN <i>June 8 to 14 1933</i>									
<i>Man</i> STATION.																			
RECAPITULATION OF PLATFORM TIME			Pay Check Number	PLATFORM TIME										DISC. CARRIED FROM SEPARATE PAY ROLL	TOTAL AMOUNT	DEDUCTIONS			BALANCE DUE
HOURS	RATE	AMOUNT		8	9	10	11	12	13	14	HOURS	RATE	AMOUNT			UNION	SUPER	ILL	
<i>259.7</i>	.22		<i>1479</i>	<i>10.6</i>	<i>11.0</i>	<i>10.6</i>	<i>12.1</i>	<i>7.0</i>	<i>14.1</i>	<i>14.1</i>	<i>68.9</i>	<i>.22</i>	<i>15.16</i>	<i>146</i>	<i>16.56</i>				<i>14.81</i>
	.25		<i>158.8</i>	<i>11.2</i>	<i>11.6</i>	<i>11.7</i>	<i>11.9</i>	<i>6.1</i>	<i>7.1</i>	<i>7.1</i>	<i>59.7</i>	<i>.25</i>	<i>14.93</i>		<i>15.77</i>				<i>13.42</i>
	.25		<i>158.7</i>	<i>14.1</i>	<i>13.2</i>	<i>3.4</i>	<i>9.6</i>	<i>7.4</i>	<i>10.1</i>	<i>10.2</i>	<i>72.2</i>	<i>.22</i>	<i>15.84</i>		<i>15.84</i>		<i>2.00</i>		<i>13.84</i>
	.25		<i>156.4</i>	<i>10.1</i>	<i>9.6</i>	<i>7.1</i>	<i>7.1</i>	<i>10.1</i>	<i>10.1</i>	<i>5.4</i>	<i>54.1</i>	<i>.26</i>	<i>14.07</i>	<i>175</i>	<i>15.84</i>				<i>15.87</i>
<i>134.7</i>	.25		<i>128.9</i>	<i>11.2</i>	<i>11.2</i>	<i>11.2</i>	<i>9.6</i>	<i>9.6</i>	<i>11.2</i>	<i>11.2</i>	<i>75.2</i>	<i>.25</i>	<i>19.18</i>		<i>19.18</i>				<i>19.18</i>
<i>101.9</i>	.25		<i>18.75</i>	<i>11.1</i>	<i>7.4</i>	<i>7.6</i>	<i>9.6</i>	<i>11.2</i>	<i>9.6</i>	<i>10.2</i>	<i>71.7</i>	<i>.22</i>	<i>15.77</i>		<i>15.77</i>				<i>14.02</i>
	.25		<i>14.86</i>	<i>10.2</i>	<i>8.4</i>	<i>8.4</i>	<i>9.6</i>	<i>11.2</i>			<i>47.8</i>	<i>.26</i>	<i>12.43</i>		<i>12.43</i>				<i>12.43</i>
	.25		<i>15.74</i>	<i>11.1</i>	<i>7.6</i>	<i>7.6</i>	<i>9.6</i>		<i>11.2</i>		<i>47.1</i>	<i>.22</i>	<i>10.36</i>		<i>10.36</i>				<i>8.61</i>
<i>496.3</i>		<i>117.98</i>									<i>496.3</i>		<i>117.98</i>	<i>345</i>	<i>121.13</i>	<i>7.00</i>	<i>2.00</i>		<i>112.13</i>

Wanted:

Weekly Time for Each Man.

Gross Wages.

Balance Due.

## METHOD

Cross-add and prove the hours and decimals on the right side of Keyboard, 10.6, 11.0, 10.6, etc. = 68.9 hours.

Add the hours for each workman.

Extending,

Hold the rate, .22, for Key Factor over the Fixed Decimal and multiply the hours, 68.9..... \$15.16

Add to this the "Miscellaneous"..... 1.40

Equals Total Amount..... 16.56

Leave the amount in Register and subtract the charges..... 1.75

Equals the Balance due..... \$14.81

Determine the amount due each man in the same manner.

Add and prove the Payroll hours and amounts as follows:

Add the "Total Amounts"..... 16.56

15.17, etc. = \$121.13

Add the "Miscellaneous"..... = 3.15

Add the "Amounts"..... 15.16

15.17, etc. = \$117.98

Leave this total in the machine and add to it the total of "Miscellaneous," 3.15, equals \$121.13, proving against the Total Amount.

Add the Deductions = 7.00 and 2.00 = \$9.00

Then add Balance Due ..... \$14.81

13.42, etc. = \$112.13

To this add the Total of Deduction..... 9.00

Equals 121.13, proving against the Total Amount..... \$121.13

Recapitulate the time

With the Payroll Sheet, right beside the Comptometer, add all of the hours for each rate; i. e., for .22c rate =

Add 68.9

72.

71.7

47.1 = 259.7 hours.

Or with 12 Column Comptometer add the hours for three rates at one time:

Hold the rates for Key Factors over Fixed Decimal and accumulate to the total of the sheet or Payroll,

259.7 × .22

134.7 × .255

101.9 × .26

Equals..... \$117.98

This proves against the Payroll Amount.

Payroll Distribution

A distribution of Payroll is made to the many classes of labor. The distribution usually includes figuring the per cents of Increase or Decrease.

## FREIGHT WORK

BUFFALO AND LAKE ERIE TRACTION CO.						
UNCOLLECTED FREIGHT BILLS.						
For <i>Fredonia</i>		Station		Month of <i>June</i> 191 <i>3</i>		
Follow instructions printed on Balance Sheet relating to Uncollected Freight Bills in rendering this report						
Date Received	BILLING REFERENCE		BILLED FROM	CONSIGNEE	TOTAL COLLECT	REMARKS
	Date	Way-Bill				
<i>May 18</i>		<i>18 1364</i>	<i>Jackson</i>	<i>C Brown</i>	<i>12 65</i>	
<i>26</i>		<i>26 1495</i>	<i>Bflo</i>	<i>F Smith</i>	<i>1 65</i>	
<i>27</i>		<i>27 1624</i>	<i>Erie</i>	<i>Larkin Co</i>	<i>2 89</i>	
<i>28</i>		<i>28 1570</i>	<i>Dunkirk</i>	" "	<i>14 65</i>	
<i>29</i>		<i>27 1675</i>	<i>Bflo</i>	" "	<i>14 65</i>	
					<i>165 40</i>	
<i>31</i>		<i>49 3741</i>	<i>Erie</i>	<i>J Smith</i>	<i>4 95</i>	
					<i>203 60</i>	

Way-Bill Extension and Revision, Abstracts of Way-Bills, Uncollected Freight Statement and Correction Summaries are all practically the same as is found in the Local Freight Work.

All require considerable adding—See Local Freight Work.

The Freight and Expense Balance Sheet contains a general analysis of earnings and expense from the various sources for each division.

The Comptometer work is all adding and cross-adding.

BUFFALO AND LAKE ERIE TRACTION COMPANY										
ABSTRACT OF LOCAL WAY-BILLS RECEIVED										
At <i>Fredonia</i>		Station		From <i>Jackson</i>		Station		Month of <i>June</i> 191 <i>3</i>		
FROM	Pro. No.	Date	Way-Bill No.	Station No.	CAR	WEIGHT	COMMODITY	FREIGHT	ADVANCES	PREPAID
<i>Jackson</i>	<i>167</i>	<i>18</i>	<i>314</i>		<i>1364</i>	<i>1800</i>	<i>See</i>	<i>12 65</i>		
	<i>169</i>	<i>18</i>	<i>318</i>		<i>1364</i>	<i>740</i>	<i>See</i>	<i>6 94</i>		
	<i>175</i>	<i>21</i>	<i>364</i>		<i>1486</i>	<i>1970</i>	<i>See</i>	<i>13 45</i>		
	<i>179</i>	<i>22</i>	<i>319</i>		<i>1364</i>	<i>2160</i>	<i>See</i>	<i>16 70</i>	<i>50</i>	
						<i>164 89</i>		<i>173 45</i>	<i>2 89</i>	<i>6 75</i>
	<i>185</i>	<i>24</i>	<i>391</i>		<i>1486</i>	<i>216</i>		<i>2 16</i>		<i>160</i>
						<i>233 73</i>		<i>225 35</i>	<i>33 9</i>	<i>835</i>

## VOUCHER RECORD

Contains the distribution of all purchase invoices to the various classes of accounts.

INTERNATION

D Monti

DATE PAID	AMOUNT OF VOUCHER	CREDITS				STORE ROOM	TRACK SUPPLIES	OPERATING EXPENSE			
		INDIVIDUAL ACCOUNTS			Discounts			Main. of Way etc.	Main. of Equipment	Traffic Expenses	Co. Tra
		Folio	Sundry	Freight Advanced							
5/9	126540	16		2460	1265			122815			
10	59070	26	560		590						
12	7645	29								7645	
14	16000	4			320						
15	75000	129									
15	94060	130								94060	
16	7523	131									
16	16075	132			1675						
17	37080	146								37080	
18	490										
192863		7640		12063		3465	49060	34565	86070		
632346		82.00		2460	3850	33986	78460	245960	34565	224850	

## COMPTOMETER WORK

The sheets are usually 24 or more inches long.

Use the Comptometer Bridge and move the sheet underneath so as to bring the adding column right beside the Comptometer.

Add the amounts of Vouchers = \$6323.46.

Add each Distribution account, 5.60, 76.40 = \$82 00.

Cross-add these totals, 82.00, 24.60, etc., = 6,323.46, and prove against the Voucher Total.

## VOUCHER REGISTER

Each general account in the Voucher Record is again subdivided into from several to 30 detailed accounts. These are entered in the Voucher Register under Maintenance of Way and Structure Account, etc.

VOUCHER REGISTER <i>June, 1910</i>	
MAINTENANCE OF WAY AND STRUCTURES	

76	340
86	2143
107	21
167	168

920	
060	
	216590
170	
	16870

742925	374600	119465	76000	172860
1286059	376090	334488	170153	406326

## COMPTOMETER WORK

The Voucher Register is usually kept on a long sheet.

Use the Comptometer Bridge and move the sheet so as to bring each adding column right next to the Comptometer.

Add the amounts of Vouchers for total:

1228.15

579.20, etc. = \$12860.59.

Add each distribution account.

Cross-add the distribution totals and prove against the Voucher Total.

## BOOKKEEPING

This will consist of the general Cash Book, Ledger work, etc.

See "Bookkeeping."

## STOREKEEPER AND SHOP ACCOUNTING

The general line of the work in this department is practically the same as that of the Railroads. See Railroads, Storekeeper, Shops, Superintendent of Motive Power.

## COMPARATIVE STATEMENT OF OPERATING REVENUES AND EXPENSES

The Comparative Statement is for the purpose of exhibiting the condition of the current business as compared with that of the previous month or year. The sheet originally contains the amounts of revenue from each source of transportation and the 1912 Results.

[illegible]

## COMPARATIVE STATEMENT OF OPERATING REVENUES AND EXPENSES—Continued

**Wanted:**

The Totals.  
 Amount of Increase or Decrease.  
 Per Cent of Increase or Decrease.  
 Earnings per Car Mile.  
 Earnings per Car Hour.  
 Per Cents of Total Receipts.

**METHOD 1****Increase or Decrease and Per Cents of same**

Add and prove the Total of June, 1913, Revenue, 182390.60, 760.45, etc. = 187330.30, Revenue from Transportation.

Continue and add to this the Operating Revenues, 760.60, 9020.60, etc. = 197547.10.

Add the 1913 Passenger Revenue, 182390.60, in the Comptometer **at the left**.

Subtract the 1912 Revenue, 179429.40 = 2961.20 **increase**.

Leave this in the register and divide by 1912 Passenger Revenue, 179429.40, using 1794 as divisor = .0165, per cent Increase.

Continue in same manner for all per cents of Increase or Decrease.

**METHOD 2**

If the amount of Increase or Decrease is not required, divide the current month revenue, \$182390.60, directly by the previous year, 179429.40 = 1.0165 or increase of .0165. For figuring per cent of decrease direct, see Negative Percentage.

**Earnings Per Car Mile and Hour**

To determine the revenue per car mile and per car hour, divide each Revenue item by the number of Car Miles and Car Hours.

The Car Miles, 56997, the Car Hours, 56144.

And the Total Receipts, \$197547.10,

Will be used as **constant divisors for each item of Revenue**; therefore, use the Reciprocal Method

Find the Reciprocal of each = 17544, 17811, 50621, respectively.

Hold the Reciprocals for Key Factors at the left of the Keyboard and multiply each item of Revenue, including Totals.

In this way figure all Revenues per Car Mile, Car Hour and the per cents of receipts. (Split the Key Factors in multiplying.)

Each column of per cents for the Car Miles, Hours and Receipts is self-balancing; i. e.,

Add the car mile per cents,

.3200

.0013

.0004, etc. = .3466, which proves against the "Total Per Cent" already obtained.

The Comparative Operating Expense,

The Comparative Income,

The Comparative Balance Sheet,

And General Statistics,

Are all worked up in the same manner, making 500 to 700 of these calculations each month.

# TRAFFIC STATISTICS

The following items are abstracted to the Traffic Statistics sheet:

Passengers, Car Miles & Hours, Passenger Earnings, Pay Roll Hours and Platform Expense.

TRAFFIC STATISTICS FOR MONTH OF JUNE, 1913.													
	Total Pass. Carried	Ave. Pass. per day of 10 hr.	Car Miles	Car Hours	Passenger Earnings	Earnings.		Pay Roll Hours.	Platform Expense	% of Exp. to Earnings	Transfers	% Trans. to Rev. Pass.	Miles Per Rev Hour.
						Per Car Mile	Per Car Hour						
Clark	1,513,544	928	171,878	16,310	56,187.49	32.69	3.44	31,607	9,635.88	17.15	521,416	34.45	10.54
Main	1,621,729	923	182,568	17,576	64,441.74	35.30	3.67	36,766	11,141.00	17.29	415,000	25.59	10.39
State	463,221	679	57,421	6,822	14,182.77	24.70	2.08	14,563	4,473.28	31.54	291,737	62.98	8.42
Union	604,849	865	70,948	6,990	23,176.95	32.67	3.32	14,875	4,507.50	19.45	183,088	30.27	10.15
Broad'y	729,381	867	87,182	8,416	24,401.65	27.99	2.90	20,579	6,273.83	25.71	558,564	49.16	10.36
	4,932,724	879	569,997	56,114	182,390.60	32.00	3.25	118,390	36,031.49	19.76	1,725,467	34.98	10.16

Wanted:

The Average Passengers per day of 10 hours  
on each Route.

Earnings per mile, per Route.

Earnings per car hour, per Route.

Percentage of Expense to Earnings.

Percentage of Transfer to Revenue Passengers.

Miles per Revenue Hour.

## METHOD

Add and prove the items abstracted from the  
Ledger.

**Average Passengers per 10 hours:**

Add in the Comptometer at the left, the total  
Passengers, 1513544, and divide by 1/10th of the  
car hours, 1631 = 928.

**Earnings per Car Mile:**

Add the Passenger Earnings, \$56187.49, in the  
Comptometer at the left and divide by the Car  
Miles, 171878. = 32.69c per car mile on Clark Route.

**Earnings per Car Hour:**

Add the Passenger Earnings, \$56187.49, in the  
Comptometer at the left and divide by the car  
hours, 16310. = \$3.44 per car hour.

**Percentage of Expense to Earnings:**

Add the Platform Expense, \$9635.88, in the  
Comptometer at the left and divide by the Passen-  
ger Earnings, \$56187.49 = 17.15%

**Percentage of Transfers to Revenue Passengers:**

Divide the Transfers, 521416, by the Passengers,  
1513544 = 34.45%

**Miles Per Revenue Hour:**

Divide the Car Miles, 171878, by the car hours,  
16310 = 10.54 miles per hour.

Continue in this manner for all other lines and  
for the averages and per cents for the month.



## DECIMAL EQUIVALENTS OF COMMON FRACTIONS

4ths	6ths	8ths	12ths	16ths	32nds	64ths			
1 .25	1 .1667	1 .125	1 .0833	1 .0625	1 .03125	1 .0156	35 .5469		
2 .5	2 .3333	2 .25	2 .1667	2 .125	2 .0625	2 .0313	36 .5625		
3 .75	3 .5	3 .375	3 .25	3 .1875	3 .09375	3 .0469	37 .5781		
	4 .6667	4 .5	4 .3333	4 .25	4 .125	4 .0625	38 .5938		
	5 .8333	5 .625	5 .4167	5 .3125	5 .15625	5 .0781	40 .625		
		6 .75	6 .5	6 .375	6 .1875	6 .0938	41 .6406		
		7 .875	7 .5833	7 .4375	7 .21875	7 .1094	42 .6563		
			8 .6667	8 .5	8 .25	8 .125	43 .6719		
			9 .75	9 .5625	9 .28125	9 .1406	44 .6875		
			10 .8333	10 .625	10 .3125	10 .1563	45 .7031		
			11 .9167	11 .6875	11 .34375	11 .1719	46 .7188		
				12 .75	12 .375	12 .1875	47 .7344		
				13 .8125	13 .40625	13 .2031	48 .75		
				14 .875	14 .4375	14 .2188	49 .7656		
				15 .9375	15 .46875	15 .2344	50 .7813		
					16 .5	16 .25	51 .7969		
					17 .53125	17 .2656	52 .8125		
					18 .5625	18 .2813	53 .8281		
					19 .59375	19 .2969	54 .8438		
					20 .625	20 .3125	55 .8594		
					21 .65625	21 .3281	56 .875		
					22 .6875	22 .3438	57 .8906		
					23 .71875	23 .3594	58 .9063		
					24 .75	24 .375	59 .9219		
					25 .78125	25 .3906	60 .9375		
					26 .8125	26 .4063	61 .9531		
					27 .84375	27 .4219	62 .9688		
					28 .875	28 .4375	63 .9844		
					29 .90625	29 .4531			
					30 .9375				
					31 .96875				
						30 .4688			
						31 .4844			
						32 .5			
						33 .5156			
						34 .5313			

## GROSS TON AND DECIMAL TABLE

## FOR USE IN CONNECTION WITH THE COMPTOMETER

RULE FOR USING TON-  
NAGE CARD

## EXAMPLE:

Find the cost of 79350 pounds at \$17.90 per ton.

On even ton table, nearest smaller number of pounds to 79350 is 78400 (88 even tons). From 79350 subtract 78400, leaving 950 pounds. Decimal table shows 950 pounds is .4241 tons.

Therefore, 79350 pounds equals 88.4241 tons.

On the **COMPTOMETER**, multiply the tons (88.4241) by the price (\$17.90), using large figured keys 1-7-9 and multiply from left to right, as follows:

Hold 179 for Key Factor on the left of Keyboard and multiply 884241; multiply first three times and then move to the right for multiplying each succeeding figure.

As there are two whole places in the price (\$17.90) and two whole places in the tons (88.4241), point off four answer holes from the left.

The Comptometer shows the answer, \$634.09.

Time required on the above should be about 18 seconds.

## GROSS TON PRICES EXPRESSED IN HUNDREDWEIGHT PRICES

Price Per Ton	Price Per Hundred	Price Per Ton	Price Per Hundred	Price Per Ton	Price Per Hundred	Price Per Ton	Price Per Hundred	Price Per Ton	Price Per Hundred	Price Per Ton	Price Per Hundred
.01	.000446	3.80	.189643	9.30	.415179	14.80	.660714	20.30	.906250	25.80	1.151786
.02	.000893	3.90	.174107	9.40	.419643	14.90	.665179	20.40	.910714	25.90	1.156250
.03	.001339	4.00	.178571	9.50	.424107	15.00	.669643	20.50	.915179	26.00	1.160714
.04	.001786	4.10	.183036	9.60	.428571	15.10	.674107	20.60	.919643	26.10	1.165179
.05	.002232	4.20	.187500	9.70	.433036	15.20	.678571	20.70	.924107	26.20	1.169643
.06	.002679	4.30	.191964	9.80	.437500	15.30	.683036	20.80	.928571	26.30	1.174107
.07	.003125	4.40	.196429	9.90	.441964	15.40	.687500	20.90	.933036	26.40	1.178571
.08	.003571	4.50	.200893	10.00	.446429	15.50	.691964	21.00	.937500	26.50	1.183036
.09	.004018	4.60	.205357	10.10	.450893	15.60	.696429	21.10	.941964	26.60	1.187500
.10	.004464	4.70	.209821	10.20	.455357	15.70	.700893	21.20	.946429	26.70	1.191964
.15	.006696	4.80	.214286	10.30	.459821	15.80	.705357	21.30	.950893	26.80	1.196429
.20	.008929	4.90	.218750	10.40	.464286	15.90	.709821	21.40	.955357	26.90	1.200893
.25	.011161	5.00	.223214	10.50	.468750	16.00	.714286	21.50	.959821	27.00	1.205357
.30	.013393	5.10	.227679	10.60	.473214	16.10	.718750	21.60	.964286	27.10	1.209821
.35	.015625	5.20	.232143	10.70	.477679	16.20	.723214	21.70	.968750	27.20	1.214286
.40	.017857	5.30	.236607	10.80	.482143	16.30	.727679	21.80	.973214	27.30	1.218750
.45	.020089	5.40	.241071	10.90	.486607	16.40	.732143	21.90	.977679	27.40	1.223214
.50	.022321	5.50	.245536	11.00	.491071	16.50	.736607	22.00	.982143	27.50	1.227679
.55	.024554	5.60	.250000	11.10	.495536	16.60	.741071	22.10	.986607	27.60	1.232143
.60	.026786	5.70	.254464	11.20	.500000	16.70	.745536	22.20	.991071	27.70	1.236607
.65	.029018	5.80	.258929	11.30	.504464	16.80	.750000	22.30	.995536	27.80	1.241071
.70	.031250	5.90	.263393	11.40	.508929	16.90	.754464	22.40	1.000000	27.90	1.245536
.75	.033482	6.00	.267857	11.50	.513393	17.00	.758929	22.50	1.004464	28.00	1.250000
.80	.035714	6.10	.272321	11.60	.517857	17.10	.763393	22.60	1.008929	28.10	1.254464
.85	.037946	6.20	.276786	11.70	.522321	17.20	.767857	22.70	1.013393	28.20	1.258929
.90	.040179	6.30	.281250	11.80	.526786	17.30	.772321	22.80	1.017857	28.30	1.263393
.95	.042411	6.40	.285714	11.90	.531250	17.40	.776786	22.90	1.022321	28.40	1.267857
1.00	.044643	6.50	.290179	12.00	.535714	17.50	.781250	23.00	1.026786	28.50	1.272321
1.10	.049107	6.60	.294643	12.10	.540179	17.60	.785714	23.10	1.031250	28.60	1.276786
1.20	.053571	6.70	.299107	12.20	.544643	17.70	.790179	23.20	1.035714	28.70	1.281250
1.30	.058036	6.80	.303571	12.30	.549107	17.80	.794643	23.30	1.040179	28.80	1.285714
1.40	.062500	6.90	.308036	12.40	.553571	17.90	.799107	23.40	1.044643	28.90	1.290179
1.50	.066964	7.00	.312500	12.50	.558036	18.00	.803571	23.50	1.049107	29.00	1.294643
1.60	.071429	7.10	.316964	12.60	.562500	18.10	.808036	23.60	1.053571	29.10	1.299107
1.70	.075893	7.20	.321429	12.70	.566964	18.20	.812500	23.70	1.058036	29.20	1.303571
1.80	.080357	7.30	.325893	12.80	.571429	18.30	.816964	23.80	1.062500	29.30	1.308036
1.90	.084821	7.40	.330357	12.90	.575893	18.40	.821429	23.90	1.066964	29.40	1.312500
2.00	.089286	7.50	.334821	13.00	.580357	18.50	.825893	24.00	1.071429	29.50	1.316964
2.10	.093750	7.60	.339286	13.10	.584821	18.60	.830357	24.10	1.075893	29.60	1.321429
2.20	.098214	7.70	.343750	13.20	.589286	18.70	.834821	24.20	1.080357	29.70	1.325893
2.30	.102679	7.80	.348214	13.30	.593750	18.80	.839286	24.30	1.084821	29.80	1.330357
2.40	.107143	7.90	.352679	13.40	.598214	18.90	.843750	24.40	1.089286	29.90	1.334821
2.50	.111607	8.00	.357143	13.50	.602679	19.00	.848214	24.50	1.093750	30.00	1.339286
2.60	.116071	8.10	.361607	13.60	.607143	19.10	.852679	24.60	1.098214		
2.70	.120536	8.20	.366071	13.70	.611607	19.20	.857143	24.70	1.102679		
2.80	.125000	8.30	.370536	13.80	.616071	19.30	.861607	24.80	1.107143		
2.90	.129464	8.40	.375000	13.90	.620536	19.40	.866071	24.90	1.111607		
3.00	.133929	8.50	.379464	14.00	.625000	19.50	.870536	25.00	1.116071		
3.10	.138393	8.60	.383929	14.10	.629464	19.60	.875000	25.10	1.120536		
3.20	.142857	8.70	.388393	14.20	.633929	19.70	.879464	25.20	1.125000		
3.30	.147321	8.80	.392857	14.30	.638393	19.80	.883929	25.30	1.129464		
3.40	.151786	8.90	.397321	14.40	.642857	19.90	.888393	25.40	1.133929		
3.50	.156250	9.00	.401786	14.50	.647321	20.00	.892857	25.50	1.138393		
3.60	.160714	9.10	.406250	14.60	.651786	20.10	.897321	25.60	1.142857		
3.70	.165179	9.20	.410714	14.70	.656250	20.20	.901786	25.70	1.147321		

## DECIMAL EQUIVALENT FOR EACH FRACTIONAL PART OF A GROSS

		DOZENS										
		1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.
Single....		12 .0833	24 .1667	36 .2500	48 .3333	60 .4167	72 .5000	84 .5833	96 .6667	108 .7500	120 .8333	132 .9167
1.....	1 .0069	13 1-1 .0903	25 2-1 .1736	37 3-1 .2569	49 4-1 .3403	61 5-1 .4236	73 6-1 .5069	85 7-1 .5903	97 8-1 .6736	109 9-1 .7569	121 10-1 .8403	133 11-1 .9236
2.....	2 .0139	14 1-2 .0972	26 2-2 .1806	38 3-2 .2639	50 4-2 .3472	62 5-2 .4306	74 6-2 .5139	86 7-2 .5972	98 8-2 .6806	110 9-2 .7639	122 10-2 .8472	134 11-2 .9306
3.....	3 .0208	15 1-3 .1042	27 2-3 .1875	39 3-3 .2708	51 4-3 .3542	63 5-3 .4375	75 6-3 .5208	87 7-3 .6042	99 8-3 .6875	111 9-3 .7708	123 10-3 .8542	135 11-3 .9375
4.....	4 .0278	16 1-4 .1111	28 2-4 .1944	40 3-4 .2778	52 4-4 .3611	64 5-4 .4444	76 6-4 .5278	88 7-4 .6111	100 8-4 .6944	112 9-4 .7778	124 10-4 .8611	136 11-4 .9444
5.....	5 .0347	17 1-5 .1181	29 2-5 .2014	41 3-5 .2847	53 4-5 .3681	65 5-5 .4514	77 6-5 .5347	89 7-5 .6181	101 8-5 .7014	113 9-5 .7847	125 10-5 .8681	137 11-5 .9514
6.....	6 .0417	18 1-6 .1250	30 2-6 .2083	42 3-6 .2917	54 4-6 .3750	66 5-6 .4583	78 6-6 .5417	90 7-6 .6250	102 8-6 .7083	114 9-6 .7917	126 10-6 .8750	138 11-6 .9583
7.....	7 .0486	19 1-7 .1319	31 2-7 .2153	43 3-7 .2986	55 4-7 .3819	67 5-7 .4653	79 6-7 .5486	91 7-7 .6319	103 8-7 .7153	115 9-7 .7986	127 10-7 .8819	139 11-7 .9653
8.....	8 .0556	20 1-8 .1389	32 2-8 .2222	44 3-8 .3056	56 4-8 .3889	68 5-8 .4722	80 6-8 .5556	92 7-8 .6389	104 8-8 .7222	116 9-8 .8056	128 10-8 .8889	140 11-8 .9722
9.....	9 .0625	21 1-9 .1458	33 2-9 .2292	45 3-9 .3125	57 4-9 .3958	69 5-9 .4792	81 6-9 .5625	93 7-9 .6458	105 8-9 .7292	117 9-9 .8125	129 10-9 .8958	141 11-9 .9792
10.....	10 .0694	22 1-10 .1528	34 2-10 .2361	46 3-10 .3194	58 4-10 .4028	70 5-10 .4861	82 6-10 .5694	94 7-10 .6528	106 8-10 .7361	118 9-10 .8194	130 10-10 .9028	142 11-10 .9861
11.....	11 .0764	23 1-11 .1597	35 2-11 .2431	47 3-11 .3264	59 4-11 .4097	71 5-11 .4931	83 6-11 .5764	95 7-11 .6597	107 8-11 .7431	119 9-11 .8264	131 10-11 .9097	143 11-11 .9930

# QUARTERS AND POUNDS EXPRESSED IN THEIR DECIMAL EQUIVALENTS OF A CWT.

Qrs.	Lbs.	Cwt.	Qrs.	Lbs.	Cwt.	Qrs.	Lbs.	Cwt.	Qrs.	Lbs.	Cwt.
●	0½	.0045	1	0	.2500	2	0	.5000	3	0	.7500
●	1	.0089	1	1	.2589	2	1	.5089	3	1	.7589
●	2	.0179	1	2	.2679	2	2	.5179	3	2	.7679
●	3	.0268	1	3	.2768	2	3	.5268	3	3	.7768
●	4	.0357	1	4	.2857	2	4	.5357	3	4	.7857
●	5	.0446	1	5	.2946	2	5	.5446	3	5	.7946
●	6	.0536	1	6	.3036	2	6	.5536	3	6	.8036
●	7	.0625	1	7	.3125	2	7	.5625	3	7	.8125
●	8	.0714	1	8	.3214	2	8	.5714	3	8	.8214
●	9	.0804	1	9	.3304	2	9	.5804	3	9	.8304
●	10	.0893	1	10	.3393	2	10	.5893	3	10	.8393
●	11	.0982	1	11	.3482	2	11	.5982	3	11	.8482
●	12	.1071	1	12	.3571	2	12	.6071	3	12	.8571
●	13	.1161	1	13	.3661	2	13	.6161	3	13	.8661
●	14	.1250	1	14	.3750	2	14	.6250	3	14	.8750
●	15	.1339	1	15	.3839	2	15	.6339	3	15	.8839
●	16	.1429	1	16	.3929	2	16	.6429	3	16	.8929
●	17	.1518	1	17	.4018	2	17	.6518	3	17	.9018
●	18	.1607	1	18	.4107	2	18	.6607	3	18	.9107
●	19	.1696	1	19	.4196	2	19	.6696	3	19	.9196
●	20	.1786	1	20	.4286	2	20	.6786	3	20	.9286
●	21	.1875	1	21	.4375	2	21	.6875	3	21	.9375
●	22	.1964	1	22	.4464	2	22	.6964	3	22	.9464
●	23	.2054	1	23	.4554	2	23	.7054	3	23	.9554
●	24	.2143	1	24	.4643	2	24	.7143	3	24	.9643
●	25	.2232	1	25	.4732	2	25	.7232	3	25	.9732
●	26	.2321	1	26	.4821	2	26	.7321	3	26	.9821
●	27	.2411	1	27	.4911	2	27	.7411	3	27	.9911

# DECIMAL EQUIVALENTS OF PENCE AND PENCE FRACTIONS OF ONE SHILLING

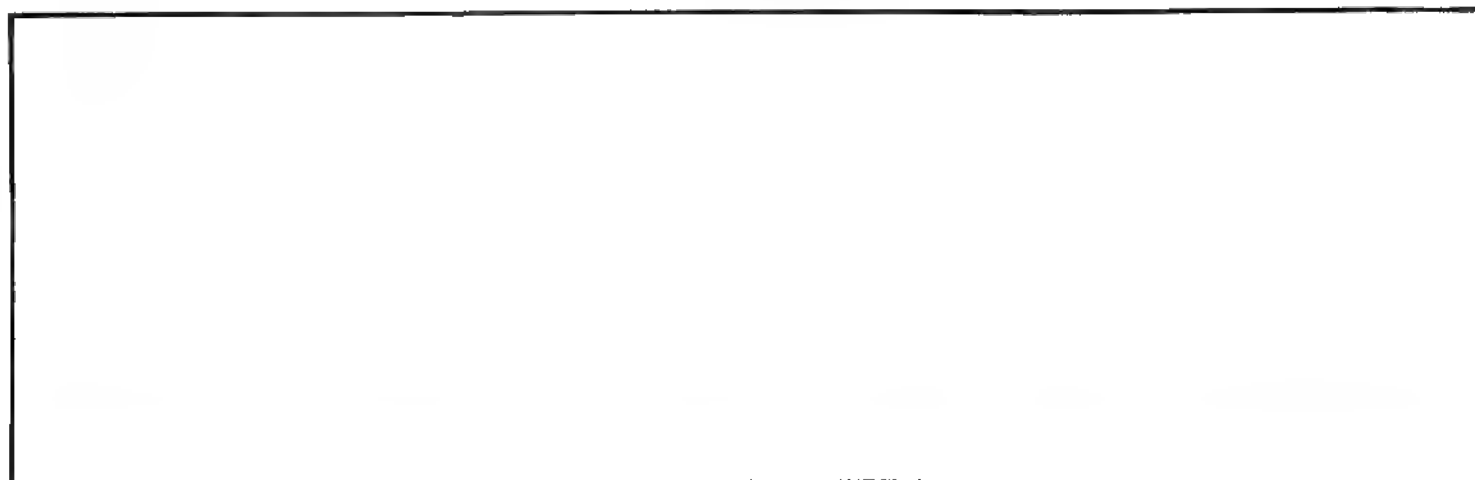
	1	2	3	4	5	6	7	8	9	10	11
	.0633	.1267	.1900	.2533	.3167	.3800	.4433	.5067	.5700	.6333	.6967
¼	.0208	.1042	.1875	.2708	.3542	.4375	.5208	.6042	.6875	.7708	.8542
½	.0417	.125	.2083	.2917	.375	.4583	.5417	.625	.7083	.7917	.875
¾	.0625	.1458	.2292	.3125	.3958	.4792	.5625	.6458	.7292	.8125	.8958

## PENCE AND FRACTIONS OF PENCE EXPRESSED IN THEIR DECIMAL EQUIVALENTS OF £1

	0	1	2	3	4	5	6	7	8	9	10	11
$\frac{1}{25}$	.00013	.004397	.008464	.01253	.016797	.020964	.02513	.029297	.033464	.03763	.041797	.045964
$\frac{2}{25}$	.000391	.004557	.008724	.012891	.017057	.021224	.02539	.029557	.033724	.037891	.042057	.046224
$\frac{3}{25}$	.000651	.004818	.008984	.013151	.017318	.021484	.025651	.029818	.033984	.038151	.042318	.046484
$\frac{4}{25}$	.000911	.005078	.009245	.013411	.017578	.021745	.025911	.030078	.034245	.038411	.042578	.046745
$\frac{5}{25}$	.001172	.005339	.009505	.013672	.017839	.022005	.026172	.030339	.034505	.038672	.042839	.047005
$\frac{6}{25}$	.001432	.005599	.009766	.013932	.018099	.022266	.026432	.030599	.034766	.038932	.043099	.047266
$\frac{7}{25}$	.001693	.005859	.010026	.014193	.018359	.022526	.026693	.030859	.035026	.039193	.043359	.047526
$\frac{8}{25}$	.001953	.00612	.010286	.014453	.01862	.022786	.026953	.03112	.035286	.039453	.04362	.047786
$\frac{9}{25}$	.002214	.00638	.010547	.014714	.01888	.023047	.027214	.03138	.035547	.039714	.04388	.048047
$\frac{10}{25}$	.002474	.006641	.010807	.014974	.019141	.023307	.027474	.03164	.035807	.039974	.044141	.048307
$\frac{11}{25}$	.002734	.006901	.011068	.015234	.019401	.023568	.027734	.031901	.036068	.040234	.044401	.048568
$\frac{12}{25}$	.002995	.007161	.011328	.015495	.019661	.023828	.027995	.032161	.036328	.040495	.044661	.048828
$\frac{13}{25}$	.003255	.007422	.011589	.015755	.019922	.024089	.028255	.032422	.036589	.040755	.044922	.049089
$\frac{14}{25}$	.003516	.007682	.011849	.016016	.020182	.024349	.028516	.032682	.036849	.041016	.045182	.049349
$\frac{15}{25}$	.003776	.007943	.012109	.016276	.020443	.024609	.028776	.032943	.037109	.041276	.045443	.049609
$\frac{16}{25}$	.004036	.008203	.01237	.016536	.020703	.02487	.029036	.033203	.03737	.041536	.045703	.04987

	0	1	2	3	4	5	6	7	8	9	10	11
		.004167	.008333	.0125	.016667	.020833	.025	.029167	.033333	.0375	.041667	.045833
$\frac{1}{12}$	.002083	.00635	.010417	.014583	.01875	.022917	.027083	.03125	.035417	.039583	.04375	.047917
$\frac{1}{6}$	.001042	.003208	.006375	.010542	.014708	.018875	.023042	.027208	.031375	.035542	.039708	.043875
$\frac{2}{3}$	.003125	.007292	.011458	.015625	.019792	.023958	.028125	.032292	.036458	.040625	.044792	.048958
$\frac{1}{3}$	.000521	.004688	.008854	.013021	.017188	.021354	.025521	.029688	.033854	.038021	.042188	.046354
$\frac{2}{5}$	.001563	.005729	.009896	.014063	.018229	.022396	.026563	.030729	.034896	.039063	.043229	.047396
$\frac{3}{5}$	.002804	.006771	.010838	.014904	.018971	.023038	.027104	.031171	.035238	.039304	.043371	.047438
$\frac{4}{5}$	.003646	.007812	.011979	.016146	.020312	.024479	.028646	.032812	.036979	.041146	.045312	.049479
$\frac{1}{10}$	.00026	.004437	.008304	.01217	.016037	.019904	.02377	.027637	.031504	.03537	.039237	.043104
$\frac{2}{10}$	.000731	.004948	.009115	.013281	.017448	.021615	.025781	.029948	.034115	.038281	.042448	.046615
$\frac{3}{10}$	.001302	.005469	.009635	.013802	.017969	.022135	.026302	.030469	.034635	.038802	.042969	.047135
$\frac{4}{10}$	.001823	.00599	.010156	.014323	.01849	.022656	.026823	.03099	.035156	.039323	.04349	.047656
$\frac{5}{10}$	.002344	.00651	.010677	.014844	.01901	.023177	.027344	.03151	.035677	.039844	.04401	.048177
$\frac{6}{10}$	.002865	.007031	.011198	.015365	.019531	.023698	.027865	.032031	.036198	.040365	.044531	.048698
$\frac{7}{10}$	.003385	.007552	.011719	.015885	.020052	.024219	.028385	.032552	.036719	.040885	.045052	.049219
$\frac{8}{10}$	.003906	.008073	.01224	.016406	.020573	.02474	.028906	.033073	.03724	.041406	.045573	.04974

**PENCE AND 16ths AND 32nds OF A PENNY EXPRESSED IN DECIMAL EQUIVALENTS OF A SHILLING, FOR USE IN CONNECTION WITH THE COMPTOMETER**



d.	0	1	2	3	4	5	6	7	8	9	10	11
1	.002604	.0859375	.169271	.252604	.3359375	.419271	.502604	.5859375	.669271	.752604	.8359375	.919271
5	.0078125	.0911456	.174479	.2578125	.341146	.424479	.5078125	.591146	.674479	.7578125	.841146	.924479
6	.013021	.096354	.1796875	.263021	.346354	.4296875	.513021	.596354	.6796875	.763021	.846354	.9296875
7	.018229	.1015625	.184896	.268229	.3515625	.434896	.518229	.6015625	.684896	.768229	.8515625	.934896
8	.0234375	.106771	.190104	.2734375	.356771	.440104	.5234375	.606771	.690104	.7734375	.856771	.940104
11	.028646	.111979	.1953125	.278646	.361979	.4453125	.528646	.611979	.6953125	.778646	.861979	.9453125
13	.033854	.1171875	.200521	.283854	.3671875	.450521	.533854	.6171875	.700521	.783854	.8671875	.950521
18	.0390625	.122396	.205729	.2890625	.372396	.455729	.5390625	.622396	.705729	.7890625	.872396	.955729
17	.044271	.127604	.2109375	.294271	.377604	.4609375	.544271	.627604	.7109375	.794271	.877604	.9609375
19	.049479	.1328125	.216146	.299479	.3828125	.466146	.549479	.6328125	.716146	.799479	.8828125	.966146
21	.0546875	.138021	.221354	.3046875	.388021	.471354	.5546875	.638021	.721354	.8046875	.888021	.971354
23	.059896	.143229	.2265625	.309896	.393229	.4765625	.559896	.643229	.7265625	.809896	.893229	.9765625
28	.065104	.1484375	.231771	.315104	.3984375	.481771	.565104	.6484375	.731771	.815104	.8984375	.981771
27	.0703125	.153646	.236979	.3203125	.403646	.486979	.5703125	.653646	.736979	.8203125	.903646	.986979
29	.075521	.158854	.2421875	.325521	.408854	.4921875	.575521	.658854	.7421875	.825521	.908854	.9921875
31	.0807292	.1640625	.247396	.330729	.4140625	.497396	.580729	.6640625	.747396	.830729	.9140625	.997396

12 COLUMN MODEL "E" COMPTOMETER



**COMPTOMETER WITH A FRACTIONAL  
COLUMN IN 4ths**

Made in 8, 10 and 12-column sizes.

**COMPTOMETER WITH A FRACTIONAL  
COLUMN IN 8ths**

Made in 8, 10 and 12-column sizes.

**MODEL "E" COMPTOMETERS WITH FRACTIONAL COLUMNS IN 12ths**

**The Values of Fractional Key Tops and Accumulator  
Indicated in 12ths.**

Adds feet and inches, dozens and gross, etc.  
Made in 8, 10 and 12-column sizes.

**The Values of Fractional Key Tops and Accumulator  
Indicated in Multiples of 5 Minutes.**

Adds hours and minutes, etc.  
Made in 8, 10 and 12-column sizes.

**COMPTOMETER WITH FRACTIONAL COLUMNS  
IN DOUBLE 12ths**

Used for calculating glass; also gross, dozen and  
units, etc.

Made in 8, 10 and 12-column sizes.

**COMPTOMETER WITH FRACTIONAL COLUMNS  
IN 12ths AND 8ths**

Adds feet, inches and fractions of an inch, etc.  
Used principally by engineers, contractors and architects  
in accumulating various dimensions.

**MODEL "E" COMPTOMETER WITH SINGLE  
COLUMN OF 60ths**

For adding hours, minutes, etc.  
Made in 10 and 12-column sizes.

**MODEL "E" COMPTOMETER WITH DOUBLE  
COLUMNS OF 60ths**

For adding hours, minutes, seconds, etc.  
Made in 10 and 12-column sizes.

**MODEL "E" COMPTOMETER WITH COLUMNS FOR  $\mathcal{L}$ ,  $a$ ,  $d$  AND  $f$ .**

Made in 8, 10 and 12-column sizes.



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